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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

FEBRUARY 10.

Lincoln Engineering Society:—Ordinary meeting at Lincoln. "The Romance of Electricity," Paper by A. S. M. Fleming, C.B.E., M.Sc.

FEBRUARY 13.

Ceramic Society, Stoke-on-Trent:—Ordinary meeting. "Practical Experience of Firing Refractory Materials with Oil." Paper by F. West.

FEBRUARY 14.

Institute of Marine Engineers:—Ordinary meeting in London. "Corrosion of Iron and Steel, with Special Reference to Steam Boilers," Paper by Geo. S. Irving.

FEBRUARY 21-24.

Carbonisation Conference, Birmingham.

Institute of British Foundrymen.

FEBRUARY 11.

East Midlands Branch:—Ordinary meeting at Derby. "Practical Jobbing Work; Moulding in Loam, Green and Dry Sand," Paper by A. Sutcliffe.

Scottish Branch:—Ordinary meeting at Glasgow. "The Moulding and Casting of Small Pulleys and Gear Blanks," Paper by J. Longden.

West Riding of Yorkshire Branch:—Ordinary meeting at Bradford. "High Silicon (Acid-Resisting) Irons," Paper by E. Whittaker.

London Junior Section:—Visit Messrs. Fraser & Chalmers' Engineering Works at Erith, Kent.

FEBRUARY 14.

Lancashire Branch (Burnley Section):—Ordinary meeting at Burnley. Mr. Goodyer, B.Sc., will read a Paper on "Semi-Steel."

FEBRUARY 17.

Sheffield and District Branch:—Lecture on "Cupola Refractories," by W. J. Rees.

Middlesbrough Branch:—Ordinary meeting at Middlesbrough "Cupola Design," Paper by Lieut.-Col. E. L. Johnson.

FEBRUARY 18.

Lancashire Branch (Junior Section):—Ordinary meeting at Manchester. "A Talk on the Cupola," Paper by A. Phillips.

Scottish Branch (Falkirk Section):—Ordinary meeting at Falkirk. "The Function of Coke in the Cupola," Paper by R. Hay, Ph.D., B.Sc.

Wales and Monmouth Branch:—Ordinary meeting at Cardiff. "Pattern-making," Paper by R. G. Williams.

Precept and Practice.

There has been a good deal of somewhat vague talk recently about the example of Germany in the matter of business methods and industrial efficiency, but on the whole any detailed study of the question has been left to the few who are able to visit the country. The last report on economic and financial conditions in Germany, published not long ago, admirably filled a long-felt want, being authoritative, detailed, and practical.

In view of attempts made in this country to stimulate rationalisation, it is of some significance to see how much importance is attached to it by the writer of this report. They emphasise not only its importance, but also the fact that it is in large measure synonymous with combination. "The most important . . . phase of rationalisation is . . . concentration in industry." And, again, "the combines of the past two years are . . . based on principles which are likely to ensure permanency." Vereinigte Stahlwerke is cited, also prominent examples in the shipbuilding, cement, linoleum and match industries. It is added that "every branch of industry is increasing in health and strength by the elimination of waste and unfruitful competition . . . there can be no doubt that this form of rationalisation has contributed very materially to the present satisfactory condition of German industry."

Industrial combination does not as a rule appeal very readily to the English mind, appearing as too dangerous an attack on our characteristic individualism. No amount of precept alone, based on the example of Germany or any other country, suffices to break down this barrier of slightly suspicious prejudice, although the gradual increase in combinations and groups as against small individual units must be obvious on any careful study of British industry over the last decade or so.

But it is now possible to point to practice as well as precept, and that very near at home. Three recent instances of industrial combination in this country may be cited—the formation of Imperial Chemical Industries, Limited, the Vickers-Armstrong amalgamation, and the formation of marketing associations among South Wales and "Three Counties" coalowners to consider methods of improving marketing and maintaining stability in prices. The only special virtue that resides in these instances is that they represent very different types of combination in very different industrial fields, and as such are invaluable examples of an industrial tendency that can no longer be denied.

Consideration of the possible advantages of combination in British industry has hitherto been effectually blocked by a belief that it was a foreign growth such as never had been and never would be acceptable in this country. The actual formation of successful combinations, whether they be concerned with selling or with management, does at least pave the way for a fairer consideration of the possible advantages to be gained by similar methods in other fields.

Inherent Properties of Cast Iron.

A little more light has been thrown on this interesting subject by M. Le Thomas, who is attached to the French Naval Dockyards at Indret, in a paper which he presented to the Academie des Sciences. He views the problem as being directly associated with the form and distribution of the graphite lamellæ, these latter being supposed to persist without appreciable change from one melting to another. In order to obtain some proof, Monsieur Le Thomas melted some high-tensile cast iron having a pearlitic structure in a crucible. It contained 3.25 total carbon, 0.73 combined carbon, 1.42 silicon, 0.52 manganese, 0.06 sulphur, and 0.27 per cent. phosphorus. When liquid, part was cast into a hot dry sand mould forming a large cube, and part into a cold chill of small dimensions. The two castings were then simultaneously remelted in two adjoining crucibles in the same furnace and then cast into 20 mm. test bars formed from cold dry sand moulds. The two series were then tested chemically, mechanically, microscopically, and dilatometrically. That which had previously been chill-cast showed slightly higher tensile, Brinell and transverse. Microscopical evidence was confirmatory of the mechanical tests, the graphite being larger in the case of the iron previously cast in hot moulds. Chemical analyses, even with respect to the combined carbon, were uniform throughout the two series. Dilatometrically a certain amount of difference in the forms of the curves was displayed. Thus, this research seems to establish that chemical analysis does not tell the whole story of the physical properties of cast iron; that the properties of an iron do in some indeterminate measure persist in remelting under normal conditions; that scientific evidence will in the near future be forthcoming to confirm the difference in value between cold-blast and hot-blast iron, which the market has accorded to it for so many years.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The Metallurgical Position of British Foundries.

To the Editor of the Foundry Trade Journal.

Sir,—Mr. Young's Papers and talks are always interesting reading; this is the case with that reported in your issue of the 2nd inst., on page 75, and the discussion is even more interesting.

First, let me protest against Mr. Young continuing to cry out about the backwardness of the British foundry industry, for, in comparison, he is entirely wrong, as is also his reference to foreign countries being so much ahead of us in metallurgical foundry matters.

Is it merely a coincidence that Dr. Moldenkie, a few years ago, in Sheffield, in the very same room in which Mr. Young was speaking, stated that one of the leading foundries in America had 25 per cent. wasters? As against this statement, in one of the light castings foundries, for a period of six months, the shop wasters were 1¼ per cent. and a further 1 per cent. from "crazing" and "annealing," whilst in a heavy castings foundry the total wasters are given to me as under 1 per cent., of which half is metallurgical.

As a much older man than Mr. Young, allow me to say that steel mixtures were used in this country over 30 years ago, and I am of opinion that in this respect America followed us, not we them.

Further, 18 years ago, when America was crying out from the housetops that only silicon and sulphur in pig-iron mattered, a representative British Committee, sitting in London, told them they were wrong. Americans have found out their mistake, and are now following the British lead by considering grain size (fracture) condition of graphite, etc., which is also what Mr. Young is *now* doing.

Also with regard to heated moulds, these were used in England about 18 years ago, and for certain purposes have been in use continually in this country for 60 years, yet, a few years ago this heating of moulds was brought from Germany as quite new!

It is my pleasure to know many practical men who, whilst they have had no technical training, can truly be called metallurgists, and also many technical men who have now had considerable practical experience, and the foundries which these gentlemen control are splendidly run. In metallurgical matters, America has little to teach such gentlemen, although in mass production and hustle they may have.

Let me again quote Dr. Moldenkie, also in Sheffield, that gentleman stated, after his visit here, that he realised why we in this country regularly obtained better results than they did in America, i.e., *by our grasp of detail in metallurgical matters.* Such a statement coming from Dr. Moldenkie, whose life has been spent in American foundries, gives the lie to Mr. Young that we are so much behind foreign countries.

Like many others, Mr. Young uses the term "science" very loosely. Science is only another name for knowledge, and I have always held that the practical man's knowledge is as much truly scientific as any work which has been done in the laboratory building, for, after all, as Mr. C. K. Everitt stated, at a dinner recently held in Sheffield, "a works is one huge laboratory."

Britain has taught the modern world metallurgy, and the fact that it is admitted we still lead the way in producing ferrous materials of best quality shows that we still have grasp of detail in metallurgical matters which some countries have not.—Yours, etc.,

E. Adamson.

18, York Street, Sheffield.
February 6, 1928.

Pearlitic Cast Iron and Babbit Metal.

To the Editor of the Foundry Trades Journal.

Sir,—In reply to Mr. Young's criticism of a point I raised in my Paper to the Sheffield Branch of the I.B.F. on "Pearlitic Cast Iron."

First of all, I would like to point out that I did not intend my remarks on the wear of a babbit or gunmetal bearing to be a strict "comparison."

I gave it more as a simile to show that a metal having a high Brinell number did not necessarily mean it would give good wearing qualities.

On that point I think Mr. Young will agree with me.

As to the reason "why" or "how" a babbit or gun-metal bearing wears, I would refer Mr. Young to the work of Portevin and Nusbaumer, Paper given to I.A.T.M. in New York, 1912. This point is referred to on page 175 of "Gunmetal" by H. S. and J. S. G. Primrose.

This work on the non-ferrous metals is confirmed later by Meyer and Nehl ("S. & E.," November 20, 1923) for the ferrous metals.

Seeing that Mr. Young is a metallurgist and I only a foundryman, he will better understand the meaning of the "skin" effect, proved by the above experimenters.

One of my reasons for giving Papers to the Institute was to learn, and hoping at the same time to interest and perhaps enlighten others. I have certainly attained my object in this case.

I might say I had expected some criticism from Mr. Young on the main subject of my Paper, seeing he is an eminent authority on that subject, but not on such a minor point which he has raised.—Yours, etc.,

A. J. Richman.

"Strathaven,"
Brooks Hall Road, Ipswich.

Stabilising Tin Prices.

To the Editor of The Foundry Trade Journal.

Sir,—In all the discussion that has taken place on the subject of stabilising the price of tin little consideration has been given to the interests of Cornwall, which once was the world's chief source of supply. Admittedly, the output of the Cornish mines to-day is small compared with the amounts produced annually in Malaya and Nigeria, but it is still a factor be reckoned with, and it may again become important if the shortage of tin predicted by the experts within the lifetime of the present generation becomes acute.

In my judgment stabilisation of price at something between £275 and £300 a ton is a vital necessity if the mines of Cornwall are to continue at work. At present fluctuations in price are driving them into the bankruptcy court. It may not matter seriously to the rich alluvial mines of Malaya whether tin drops £50 a ton or rises £50 a ton. The only difference is the amount of their profit. But it is a matter of life and death to the lode mines of Cornwall to be asked, or rather forced, to accept starvation prices for their hardly won tin.

In saying this, I am not suggesting that the consumer should be asked to pay a price which would cripple demand. I am suggesting that it is uneconomical to continue our present method of haphazard production, when, by fixing the selling price of tin at a reasonable level, the speculative element, which is the chief cause of complaint, could be eliminated, and innumerable bankruptcies and consequent hardships avoided among the less favoured mines of the Empire.

Yours, etc.,

Herbert Thomas.

"The Cornishman," Parade Street, Penzance.
February 1.

B.C.I.R.A. Elects New Members.

Ordinary Members.—S. E. Dawson & Company, Limited, Manchester; representative, Mr. S. E. Dawson, F.I.C., A.M.C.Tech. John B. Lang & Sons, Limited, Glasgow; representative, Mr. John B. Lang. Tweedales & Smalley (1920), Limited, Manchester; representative, Mr. Walter Tweedale, M.I.Mech.E.

Trade Members.—Alldays & Onions, Limited, Birmingham; representative, Mr. F. W. Berk. Dunford & Elliott (Sheffield), Limited, Sheffield; representative, Mr. W. Finlay Slater.

Mr. H. G. Sommerfield, the popular honorary secretary of the London Branch of the Institute of British Foundrymen, has been admitted to the livery of the Bakers' Company and freedom of the City of London. Mr. Sommerfield is also a councillor of the Urban District of Finchley.

Random Shots.

I see that another of our perambulating annual meetings has fallen captive to the charms of Spain as a "milieu," and the Iron and Steel Institute proposes to visit Bilbao in September next. Of all the technical societies, it is surely the most adventurous—or possibly the most restless. Most of us are content to spread our wings in foreign air just once in a while, but the Iron and Steel Institute evidently believes in fostering foreign travel!

* * *

September, however, is long enough ahead, and all sorts of things may happen by then. We have been assured on excellent authority that there will not be a general election in the interval, however—the reasons are added that the early months of the session are always occupied with routine and non-controversial business, while no Government of whatever party colour would venture to interfere with the summer holiday months. I do not doubt this latter fact, but I should like to hear the explanation.

* * *

Is it, for instance, that our Members of Parliament are so delightfully altruistic that they would not care to cut across our care-free gambols at the sea, on the tennis courts, or in the mountains—always supposing that we *are* care free, and *do* gambol—with the rude clamour of an election? If so, it must surely be a high type of humanity from which our representatives at Westminster are drawn. Or is it—whisper it low—that they are afraid we might refuse to be diverted from our traditional August occupations even for the sake of that still more traditional occupation of the Britisher, taking a polite interest in politics, so that they would not be afforded quite the usual measure of limelight? Although, being the silly season, they could rely on the warm support of the daily Press, which would no doubt welcome election news as an improvement on the sea-serpent.

* * *

No; deep experience of human nature compels me to admit that the most probable reason seems to me to be that the M.P. likes his own holiday—I do not deny that he earns it—whether it be at Aix or in South America or just vegetating on his country estate, and even if he be of those politicians born, to whom the strife of election time is meat and drink, he *does* like August undisturbed.

* * *

So do I—if I can get it. On the whole, people whose jobs come in patches, as it were, seem to have the best of it; they may have to sit up all night for a week or two at a time, but think of the joy of several weeks of complete holiday afterwards! It seems a heavenly state of affairs to the rest of us, compelled as we are to go on jog-trotting with our jobs for ever on our shoulders for some part of the twenty-four hours, if not for all.

* * *

Marksman's Little Tales of Success.

No. 1.—Marmaduke Moggs.

Marmaduke Moggs managed the foundry as one department of a large concern, and he was beginning to realise that he was, in the picturesque language of our Western friends, "up against it." Rather than make a mistake he had for years consistently "passed the buck" to some other fellow whenever responsibility had been put up to him. The organisation had carried him, and had carried him well, but he saw the end in sight. Already his departmental overhead reached 50 per cent. of his monthly wages bill of £1,000. The Big Boss had warned him that this must come down. After a few sleepless nights and the application of sundry wet towels he solved the problem. Not for nothing—about 100 guineas, to be exact—had he taken correspondence courses. He sent round to the Labour Exchange for another twenty men, thereby raising his wages bill to £1,200, and so reduced his overhead to 40 per cent.

Marmaduke is now a made man.

Marksman.

The Yield Point in Steel at Various Temperatures.*

By Professor J. Muir, D.Sc.

The phenomenon of the yield point in steel is one of considerable importance, and, although much experimental work has been done, the subject is still wrapped in obscurity. The simple tension experiments about to be described were made on a good quality of steel wire, kept at various temperatures by passing an electric current through the wire. The wire was specially drawn by Messrs. James Royston, Son & Company, Limited, Halifax, who also kindly supplied the following analysis of the steel or "Best Iron" used:—Carbon, 0.05 per cent.; manganese, 0.30 per cent.; phosphorus, 0.016 per cent.; sulphur, 0.032 per cent. The wire was of diameter about 0.024 inch. It could not be supplied in straight-drawn lengths, but only in a coil of 8 in. dia. A tension test of the wire in the condition as supplied gave a breaking stress of 52 tons per sq. in., but the break occurred at the clamped end of the wire. The phenomenon of the yield point was, of course, not observed with the unannealed wire. Very perfect elasticity was shown up to the stress of 30 tons per sq. in.; then there was a slight and gradually increasing departure from elastic behaviour. Only the small permanent extension of 0.25 cm. on a 300-cm. wire at room temperature (17 deg. C.). It will suffice to plot load against extension rather than stress against strain; the diameter of the wire, however, was such that a load of 1 lb. corresponded very nearly to a stress of 1 ton per sq. in. If the load was on the initial area of cross-section 1 lb. to 0.98 tons per sq. in.; but after the wire had received large permanent stretch, 1 lb. might correspond to a stress as high as 1.08 tons per sq. in.

Curve 1 (Fig. 1) shows that the wire was perfectly elastic up to a load of 20 lbs., when creeping was detected, and load began gradually and automatically to be removed by the spring balance attached to the 4-lb. weight resting on the pan. After 36 min. (point *b*) an extension of 4.3 cm. had occurred and the load had been reduced to 18 lbs. The creeping was now extremely slow; it was, nevertheless, allowed to continue for another 114 min. (point *c*) when the load on the wire was 17.5 lbs., and creep could still be detected at the rate of, perhaps, 0.002 cm. per min. on 280 cm. The load was then increased to the initial value of 20 lbs.; the rate of creep rapidly increased (to about 2 cm. per min.), and after 12 min. entirely and suddenly ceased. No further extension was

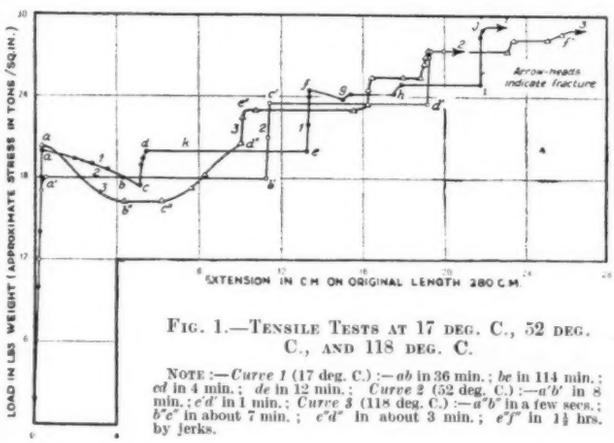
LOAD IN LBS WEIGHT (APPROXIMATE STRESS IN TONS/SQ.IN.)
EXTENSION IN CM. ON ORIGINAL LENGTH 280 C.M.
Arrow-heads indicate fracture

FIG. 1.—TENSILE TESTS AT 17 DEG. C., 52 DEG. C., AND 118 DEG. C.

NOTE:—*Curve 1* (17 deg. C.):—*ab* in 36 min.; *bc* in 114 min.; *cd* in 4 min.; *de* in 12 min.; *Curve 2* (52 deg. C.):—*a'b'* in 8 min.; *c'd'* in 1 min.; *Curve 3* (118 deg. C.):—*a"b"* in a few secs.; *b"c"* in about 7 min.; *c"d"* in about 3 min.; *e"f"* in 1½ hrs. by jerks.

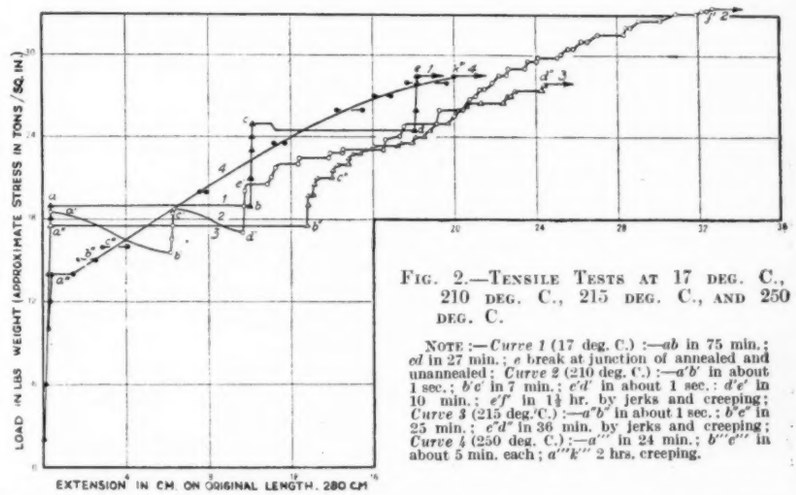

FIG. 2.—TENSILE TESTS AT 17 DEG. C., 210 DEG. C., 215 DEG. C., AND 250 DEG. C.

NOTE:—*Curve 1* (17 deg. C.):—*ab* in 75 min.; *cd* in 27 min.; *e* break at junction of annealed and unannealed; *Curve 2* (210 deg. C.):—*a'b'* in about 1 sec.; *b'c'* in 7 min.; *c'd'* in about 1 sec.; *d'e'* in 10 min.; *e'f'* in 1½ hr. by jerks and creeping; *Curve 3* (215 deg.C.):—*a"b"* in about 1 sec.; *b"c"* in 25 min.; *c"d"* in 36 min. by jerks and creeping; *Curve 4* (250 deg. C.):—*a'''* in 24 min.; *b'''c'''* in about 5 min. each; *a'''k'''* 2 hrs. creeping.

length had occurred when the wire broke. All other experiments to be described were made on annealed specimens of this wire. The annealing was performed in an atmosphere of nitrogen to avoid oxidation, and all specimens were subjected as nearly as possible to the same preliminary heat treatment. All specimens were similarly annealed at a bright red, but not accurately-known, temperature.

The tension tests were made with the wire horizontal, one end firmly clamped, the other passing over a pulley, and supporting a scale pan weighing 2 lbs. Load was added to the pan by increments of 4 lbs., 2 lbs., down to 0.25 lb., and as it was found that extension which occurred at a yield point took place with extreme rapidity (except at low temperatures), a 4-lb. weight resting on the pan was attached to a spring balance supported by a rack above the pan, so that rapid extension was checked automatically by the gradual removal of load. The extension of the wire was measured by two reading microscopes, focussed on small drops of seccotine attached at points 280 cm. apart. Thus, 10 cm. of annealed or partially-annealed wire were left at each end outside the measured length, and the end fixtures were made on strong unannealed wire.

Curve 1 (Fig. 1) shows the applied load in pounds weight plotted against the extension in cm. on the 280-cm. length, for a specimen of the detected, although the 20-lb. load was allowed to remain on for 16 hrs.

The total extension which occurred at the yield point was, say, 13 cm. on the 280-cm. length, or about 4.6 per cent. During the extension at the yield point each small portion of material stretched at once the full 4.6 per cent., and the action was transmitted piecemeal from particle to adjoining particle, so that, for example, at the point *k* of Curve 1 (Fig. 1), one half of the length of wire had stretched 4.6 per cent., while the other half had received no permanent extension. The wire was now raised to about 120 deg. C. for 5 min. in order to effect recovery from overstrain. The temperature was calculated from the expansion of the wire, the coefficient of expansion for steel being known.

After the wire was again at room temperature, load was increased and the part *ef* of Curve 1 shows that perfect elasticity was again exhibited up to a load of 24.5 lbs. The creeping which started at 24.5 lbs. was at first fast, but it became so slow that another ½ lb. of load was added before creeping ceased and a full yield-point extension of 8.4 cm. (2.8 per cent.) was obtained under the load of 25 lbs.. Recovery from overstrain was again effected by keeping the wire for 5 min. at 120 deg. C., and *ij* of Curve 1 shows again a good restoration of elasticity. Fracture, however, occurred at 29 lbs., just about the load at which a third yield point was to be expected. The yield-point loads 20, 24.5, and 29 lbs. correspond to the stresses 19.7, 25.1, and 30.6 tons per sq. in. respectively. With another specimen of the wire the third yield point was safely passed at a load of 28.5 lbs., and, after recovery from overstain, elasticity was exhibited up to a load of 32 lbs. before the wire suddenly broke.

Altogether six specimens of wire were tested at room temperature with results which are given in Table I. Absolute consistency is, of course, not to be expected. The "Wire No." gives the order in which the specimens had been cut from the 8-in. coil. A length of about 450 cm. was cut off each time, so that about 63 m., or over 200 ft., of wire separated the 1st and the 15th specimens. The 1st specimen gave rather badly-defined yield points. For example, slight creeping was detected at a stress as low as 15.5 tons per sq. in. The yielding started at the end fixture, due, no doubt, to the fact that too great a length of wire had been annealed, so that annealed wire had to be fixed in the end clamp.

The 4th and 5th specimens broke at the pulley when the junction of annealed and unannealed portions of the wire was on the point of being bent there; and the 8th specimen (from which Curve 1 [Fig. 2] has been obtained) also broke at the junction of the annealed and unannealed material, but well clear of the pulley.

The 14th specimen was intended to illustrate an ordinary tensile test without recovery from overstrain; but the yield-point load (20 lbs.) was allowed to remain on for 3 hrs. No additional extension occurred, but the 3 hrs.' rest (under load) at room temperature sufficed to effect almost as good a recovery of elasticity as 5 min. at 120 deg. C. On increasing the load, good elastic behaviour was shown until 23 lbs. were applied, when large yielding (about 3 per cent.) occurred. After this the load was at once increased step by step, extensions of one or two cm. occurring at every other addition of load, until the wire fractured at the stress of 27.2 tons per sq. in., after a total extension of about 12 per cent. The 15th specimen was that used to obtain Curve 1 (Fig. 1).

The Yield Point in Steel Wire at Various Temperatures.

Wire No.	1st yield point, tons/sq. in.	1st yield point, per cent.	2nd yield point, tons/sq. in.	2nd yield point, per cent.	3rd yield point, tons/sq. in.	3rd yield point, per cent.	Fracture, tons/sq. in.
1	19.2	3.8 (48 min.)	24.5	2.4	29.7	2.8	34.4
4	19.9	4.3 (55 min.)	26.9	3.0	—	—	(28.7)
5	19.2	4.2 (65 min.)	25.8	2.5	—	—	(29.7)
8	18.7	3.4 (75 min.)	24.9	2.8	—	—	(29.0)
14	19.7	5.2 (10 min.)	—	—	—	—	27.2
15	19.7	4.6 (20 min.)	25.1	2.8	30.6	—	30.6

In the following experiments on wires kept at various temperatures by passing an electric current through them, the temperatures were measured by the expansion of the wires themselves.

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* From a contribution to "The Journal of the Royal Technical College," Glasgow.

In the "Tables Annuelles Internationales de Constantes," Vol. V, Part 1, 1917-1922, p. 11, coefficients of expansion are given for a great many different qualities of steel. The values do not differ very much, and, for the quality of steel of which the wire used in this research was made, the following values have been selected as probably very nearly correct:—Mean coefficient for 25 deg. C. to 300 deg. C. = 0.0000125; mean coefficient for 300 deg. C. to 600 deg. C., = 0.0000160.

From these values a graph—length of wire against temperature—was plotted so that the expansion corresponding to any temperature could readily be found. Curve 2 (Fig. 1) is the load-extension graph obtained for a steady temperature of 52 deg. C. The primary yield point occurred at 18 lbs. This load was lower than was obtained with any of the specimens tested at 17 deg. C., but it must be remembered that after yielding had started in the experiments at 17 deg. C., it would continue at a lower load than 18 lbs. After recovery from overstrain the specimen, kept at 52 deg. C., gave a second yield point at 23.5 lbs. and fracture occurred at the load 27.5 lbs., where a third yield point was to be expected. The only difference of importance, and it was a very surprising one, between the behaviour of the steel at 17 deg. C. and at 52 deg. C. was in the time-rate at which the extension at the yield points occurred. The times taken for various extensions are given under Fig. 1, and it will be seen that extensions occur much more rapidly at 52 deg. C. than at 17 deg. C.

Two experiments were performed with wires maintained at about 115 deg. C., the results obtained being very similar. The one wire yielded at 20 lbs., the other (Curve 3, Fig. 1) at 20.25 lbs. Yielding now took place with great rapidity; the spring arrangement removed in a few seconds, in one case 3 lbs. and in the other (Curve 3) the maximum 4 lbs. of load. Creeping supervened and the full initial load had to be replaced to get the full yield-point extension of about 10 cm. After the first yield point had been passed, Curve 3 shows four subsequent yieldings which all occurred with great rapidity; but the experiment failed to show a regular succession of yield points beyond the first. The second specimen yielded at more than four places before breaking at exactly the same load and total extension as the first.

Three experiments were performed at temperatures 165 deg., 195 deg., and 185 deg. C., but graphs for these have not been reproduced. Yielding started at 20, 20.25, and 21.5 lbs. respectively, and took place with startling rapidity. The respective yield-point extensions were 10.0, 9.5, and 16.0 cm. The wire giving the extra high initial yield-point load and the extra great extension had been annealed in air instead of in nitrogen and so was coated with a skin of oxide.

Although in these experiments at raised temperatures a regular succession of yield points beyond the first was not observed, it may be of interest to record that preliminary experiments with a different quality of steel wire were rather better in this respect. For example, a specimen kept at 160 deg. C. gave a well-defined yield point at the stress of 21.5 tons per sq. in., the extension being 5.1 per cent. On increasing the load, almost perfect elasticity was exhibited up to 28 tons per sq. in., and a yield point (with extension 4.7 per cent.) could quite justifiably be placed between 29.5 and 30.5 tons per sq. in. On the further increase of load very elastic behaviour was exhibited up to the stress of 35.5 tons per sq. in., when sudden fracture at the pulley occurred.

Fig. 2 illustrates the results of tests made at 17 deg., 210 deg., 215 deg., and 250 deg. C. In the experiment at 17 deg. C. the spring arrangement for the reduction of load was dispensed with. The yield point occurred at the load of 19 lbs., and the yield-point extension of 9.6 cm. completed itself in 75 min. at that load. In the test made at 210 deg. C. (Curve 2, Fig. 2) the initial yield-point load was 18.5 lbs., and the yield occurred in two alarming jerks. In the case of the wire tested at 215 deg. C., the spring arrangement for reduction of load was again dispensed with; yield started at 17.5 lbs., the extension raced along the wire, and an extra large extension (12.4 cm.) occurred, probably due to the inertia of the falling weight. The subsequent yielding for both experiments (210 deg. and 215 deg. C.) was by many rapid jerks. Often the microscope readings would be quite steady for a considerable time and then, for no apparent reason, a large extension would occur with great rapidity. At the higher loads creeping, as distinguished from jerks, came into evidence.

The last two experiments to be recorded were performed at 250 deg. C. and gave results in remarkably good agreement with one another. The phenomenon of jerks, the yield-point phenomenon, had now entirely disappeared. Curve 4 (Fig. 2) shows that departure from Hooke's law had occurred at even as low a load as 8 lbs., but it was not until 14 lbs. were applied that creeping became so obvious that a pause of 24 min. was made in the loading. This resulted in a slow creeping extension of about 1 cm. In the second experiment performed at 250 deg. C. a pause of 4 hrs. was made at the load of 14.5 lbs. and a slow extension of about 2 cm. resulted. As load was gradually increased pauses of 5 min. or so were made from time to time; nothing but creeping action was observed; a smooth curve (4) has, therefore, been drawn through the points of observation of the test recorded in Fig. 2, for 250 deg. C. This curve corroborates the results of experiments performed in 1899. At 250 deg. C. mild steel yields less than cold steel for loads greater than the initial yield-point stress, but more than cold steel for loads less than yield-point stress. The phenomenon of the yield point, the phenomenon of jerks, which was strongly in evidence at 215 deg. C. entirely disappeared at 250 deg. C.

The great increase in the rate of extension at a yield point, or the great increase in mobility produced by even such moderate temperatures as 50 deg. C. and 100 deg. C., is no doubt connected with the great increase, produced by the same temperatures, in the rate at which elasticity is restored after overstrain. An explanation of the effect must be left to the metallurgists.

Complimentary Luncheon to Monsieur Ropsy.

There was recently held in Brussels a function of which foundrymen all over the world would have wished to be apprised in order that they could at least have sent telegraphic felicitations. It was a luncheon offered to M. Paul Ropsy, the popular ex-President of the International Foundrymen's Committee and President of the Belgian Foundrymen's Association. The Belgian Government was represented by M. Wauters, the Minister of Labour, while amongst other prominent persons present were MM. J. Carlier, President of the Federation of Belgian Industries; Count A. Van Der Burgh, President of the Belgian Board of Exhibitions; Van Der Stegen, Mayor of Ghent; C. Dufour, President of the French Foundry Employers' Federation; L. Thomas, President of the French Foundrymen's Technical Association; and G. Masson, past-President of the Belgian Foundrymen's Association. Advantage was taken of the occasion to present M. Ropsy with the medal awarded to him by the Belgian Committee of the Paris Foundry Exhibition, held last September.

Apprenticeship and Training.—The Ministry of Labour have issued, through the Stationery Office, Part III of the Report of an Inquiry into Apprenticeship and Training for the Skilled Occupations in Great Britain and Northern Ireland, 1925-1926. This is the third of a series of seven Reports to be issued, and deals with the detailed conditions of industrial training in operation in, among others, the mining and quarrying, iron and steel manufacture, etc., industries.

International Railway Congress in Madrid, 1930.—The subjects to be discussed at the International Railway Congress in Madrid in 1930 will include, among others:—(1) Resistance of rails against breakage and to wear; (2) investigation into static and dynamic stresses in railway bridges; (3) recent improvements in permanent-way tests and in the scientific organisation of maintenance work; and (4) all-steel coaches—comparison with vehicles built of wood.

International Co-operation in Determining Gases in Metals.

For several years the United States Bureau of Standards has been interested in the development of methods for determining gases in metals, particularly in iron and steel. Recent work along this line has been the development of vacuum-fusion methods of analysis and the comparison of these with earlier methods. While the rôle which may be played by the amounts of gases normally present in commercial irons and steels is not yet clearly defined, nevertheless it is quite the general belief of interested chemists and metallurgists that the gas content of iron and stel deserves very careful study. The metallurgical laboratories of a number of American manufacturers have lately undertaken analyses for gases in metals. Similar methods of analysis are employed to some extent in England, Germany and Sweden.

In order that the data on the gas content of metals might have some basis of intercomparison, it seemed very desirable that analyses should be made on samples of the same irons and steels by a number of widely-separated laboratories. This was all the more necessary because some of the methods of analysis in general use are comparatively new and their limitations may not as yet be fully recognised. The Bureau distributed samples of an ingot iron for gas analyses to Prof. C. H. Desch, of the University of Sheffield, to the late Prof. P. Oberhoffer, of the Institut für Eisenhüttenkunde, Aachen, Germany, and to a co-operating laboratory in Sweden. The results from the English and German laboratories have recently been reported. The analyses at Aachen were carried out by Dr. Hessenbruch after the death of Professor Oberhoffer. No results are as yet available from the Swedish laboratory.

The composition of the ingot iron distributed was as follows:—Carbon, 0.04 per cent.; manganese, 0.03 per cent.; sulphur, 0.02 per cent.; silicon, 0.006 per cent.

The analyses at Sheffield were made by the hydrogen reduction method, using a solid sample with the addition of an antimony-tin alloy. The analyses at Aachen were made by a vacuum-fusion method, heating by high-frequency induction in a graphite crucible essentially as in the Bureau of Standards method. The German method, however, differs from the Bureau's method in that the evolved gases are collected and determined volumetrically. The results obtained by the co-operating laboratories are as follow:—

University of Sheffield.	Institut für Eisenhüttenkunde.		Bureau of Standards.	
Type of Analytical Method.				
Hydrogen reduction (with antimony-tin addition).	Vacuum fusion (volumetric).		Vacuum fusion (gravimetric).	
Oxygen.	Oxygen.	Hydrogen	Oxygen.	Hydrogen
Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
0.056	0.055	0.0008	0.057	0.0005
0.057	0.059	0.0008	0.059	0.0005
0.049	0.062	0.0007	0.058	0.0007
0.048	—	—	0.058	0.0008
0.049	—	—	—	—
0.051	—	—	—	—
Average 0.051	0.059	0.0008	0.058	0.0006

For this particular class of material (ingot iron), the two modifications of the vacuum-fusion method give practically the same values for oxygen. The hydrogen-antimony-tin reduction method, using a solid sample, gave a value for oxygen but slightly lower. The average value for hydrogen was slightly higher by the volumetric vacuum-fusion method than by the gravimetric vacuum-fusion method.

Similar co-operative analyses of steels and cast irons seem desirable, and steps have already been taken to initiate further co-operative work.

Mr. and Mrs. A. E. Chell were entertained last Tuesday evening, at the Savoy Hotel, to dinner by London members of the Engineering and Allied Employers' Federation. Mr. Chell is managing director of the Rodney Foundry Company.

Potted Wisdom.

Following their usual custom, the Council of the East Midlands Branch of the Institute of British Foundrymen arranged for a series of 10-minute Papers at their January meeting. These, after presentation, are discussed, and a prize is awarded to the most meritorious. Mr. H. Pemberton presided over the meeting, which was in every way enjoyable and instructive. The five Papers submitted are set out below.

A COMPARISON OF CORE BINDERS.

By B. GALE.

Core binders can be divided into four classes, as follows (1) oil; (2) cream; (3) paste; and (4) gum. All are in regular use, and this short review is to show which, in the writer's opinion, is the most suitable and economical for use in the small foundry that does not wish to have two or three different core sand mixtures in use.

Sea sand is used throughout at a ratio of 40 parts of sand to 1 part of binder. Oil mixtures can be with sand either wet or dry, but the remaining binders require dried sand, which considerably adds to costs. Mixing time varies considerably. Oil is the quicker as it leaves the measure perfectly clean and the quantity is constant. Cream and gum leaves the measure dirty, and unless time is spent in cleaning the measure each time, the subsequent quantities will be short. Paste must be packed into the measure to guarantee constant quantities, and this takes up time in mixing.

The bond in the green sand is excellent in the paste, and fairly good in cream and gum mixtures, but in oil mixtures there is no green bond. In working the sand there is no comparative difference in the oil, gum, or cream, but the paste sand must be kept covered with a damp cloth, as this sand very quickly air-dries and is useless unless remixed.

The venting properties of the dried core are excellent in the oil mixture and very good in cream and paste, but the gum appears to clog the pores and venting is not so good. If cores are to be kept in stock for periods, or should they be in the mould long before casting, oil mixtures excel, as the resultant core is very hard and waterproof. Cream and paste are not so hard, and absorb moisture slightly. Gum-sand gives a hard skin with a soft centre, and absorbs moisture rapidly.

The saving in fettling costs is considerable when comparing these sand mixtures with ordinary sand and loam cores, but it is thought there is very little difference between oil, cream, and paste cores. Gum cores leave the casting much more readily than ordinary sand cores, but are more difficult to remove than the three other classes mentioned.

From the above comparison and the author's personal experience, it is concluded that the best and most economical core binder for all-round use is the oil variety. This type of binder gives the hardest core, the most porous core, and the most consistent mixture of sand, as it is by far the most easily mixed. The only disadvantage is the lack of bond in the green state, but as a very large majority of cores can be made on flat plates, either whole or in halves, the author insists that a green bond is not necessary except in a very few cases. Also, a very large percentage of cores made in halves do not require jointing to go into the mould, and it is very often easier and cheaper to make the cores in halves on flat plates than to make them whole in a bonded sand.

To complete the statement that oil makes the most economical mixture, one must consider the cost of the binder, and whilst oil costs 3s. or 4s. per cwt. more than the remaining binders the author still maintains that it is the cheapest. A point very often overlooked is that nearly all core binder manufacturers sell by weight, while most foundries mix by volume. The writer has weighed a measure full of the four classes of binders with the following result:—Oil, 8 ozs.; cream, 11 ozs.; paste, 14 ozs.; and gum, 14 ozs. This proves that the cost of binder to the given quantity of sand is cheaper when using oil.

SCABBING: CAUSE AND EFFECT.

By F. BUTTERS.

During the discussion at the last meeting a member stated that he had once tried to make a scab casting and failed, so it is suggested with such luck he ought to take a share in the Calcutta Club Sweep-stake. From the moulder's standpoint scabbing can be placed under two heads, (1) avoidable, and due to faulty workmanship, and (2) unavoidable, due to faulty material.

Faulty ramming is often the cause of a scab, such as working the rammer too near the pattern, resulting in those unsightly loose scabs where the piece of metal leaves the body of the casting, leaving a shallow smooth recess. This type of scab is often seen on the outer rim of large fly wheels, termed rammer traps. Hard and soft places in the mould surface will often result in a scabbed casting, whilst one that is hard all over but evenly rammed will often come out satisfactorily, but still there is considerable risk.

Venting next to ramming is often not given adequate thought, for, like the ramming, especially on a fair-sized job, it is not easy—this probably accounting for many defects. Some moulders take a delight in hitting the pattern with the vent wire, and when sleeking the mould these get a thin covering of sand which the gas generated during the casting will remove, and cause scabbing. Badly placed runners are another source of trouble.

Faults Due to Unsuitable Material Supplied.

Sand of too close a texture and sand with an excess of clay in it are two of the major contributory causes. For instance, there are on occasion pieces of clay in the red sand, which, if they approach too close to the mould face, are a sure cause of scabbing. Working the sand too wet will also result in scabbing. Undoubtedly the management can remove most of the danger by supplying suitable material in proper condition to the moulder.

If a scabbed casting has to be machined, it often means the scrapping of the casting, as, apparently, most designers arrange the part to be machined where the dirt will gather. If the casting is saved, it is not a satisfactory job, nor one of which the moulder would say with pride, "I made that." One effect which is a redeeming feature is that it provides trade for the people who make "stopping," of which material some founders may have heard.

OLD SAND OR NEW?

By FREDERICK GILL.

Of the foundries that use sea-sand for making cores we find a fair number that invariably make use of the old sand that is retrieved from castings by mixing a proportion of it with new sand. This is, no doubt, done to reduce costs, but in the writer's opinion it is not a very good method to employ, as there are quite a few faults to be found in this process.

It is almost impossible for sand retrieved from castings to be clean, that is, of good grain and free from dust, and when mixed again for making cores, even if in small proportion with the new sand, the dust will fill in the vent channels. As sea-sand is mainly used for its good venting properties, this clogging of the vents with old sand is detrimental. The author has made tests and has found that there is little or nothing to be gained by carrving on with the practice of using old sand, and will relate how these tests were carried out and the results obtained.

The first mixture was made with equal proportions of old sand and new sand, with the usual amount of binder, which in this case was oil, and when cores were made the sand was found to "clag" to the core-box after the first one or two had been turned out. The cores were then put through the process of drying, the time of which proved to be longer than is necessary for drying cores of an all-new-sand mixture. The surfaces of the dried cores were cracked, and the cores would not stand so much handling owing to their being powdery. The cores were then put into the moulds and the moulds cast. When the castings were dressed it was found that the cores would not leave the castings cleanly as is usual with sea-sand cores, and consequently the fettling time was increased.

After this test it was decided to use slightly more binder and less old sand, but while agreeing that the results were better than in the first instance, it could not be said that anything was to be gained by putting this into regular practice. The author finds from these tests that the only satisfactory method of producing oil-sand cores is to use all new sand, which gives a much better core in all respects than those made with part new and part old sand. Also the cost of collecting and sieving the old sand and the cost of the extra binder necessary to give a core of reasonable hardness makes the ultimake cost of the mixed sand to be more than when using all new sea-sand.

The Book of Hiram.

By EDMUND STEVENSON.

[*With the writer's sincere apologies to the author of the Book of Artemas, whoever and whatever he or she is or was.*]

PROLOGUE.

By Hiram of Tyre, Foundry Manager to His Majesty King Solomon. 3057 B.C. or thereabouts.

CHAPTER I.

¶ I.—*Take heed, O ye sandrats, and hearken unto the words of Hiram the moulder, for many will tell thee how to make good castings, yet wisdom cometh only from a few.*

¶ II.—*Beware of the man who sayeth, "Behold, I make no wasters," for he is liken unto Ananias.*

¶ III.—*Make unto thyself a friend of the patternmaker who shapeth the trees of the forest, for he can make thy life either Heaven or Hell as it pleaseth him in his goodness or otherwise.*

¶ IV.—*Verily I say unto you, he shall have his reward.*

¶ V.—*Tread thou very carefully in the presence of the Alchemists and workers in magic with Phial and test-tube, for they may prove thine undoing to thy discomfort.*

¶ VI.—*Shouldst thou have a waster, say not, "Behold he catcheth a gagger," or thy fellow may prove an alibi, saying, "I went for silent meditation and smoke the weed aloof."*

¶ VII.—*Use not too much dust which is of the coal, lest thy handiwork be like unto the pox which is small.*

¶ VIII.—*Curse not the man of the fiery furnace if thy mould bloweth and frotheth like unto the bottle which is of the Bass, for verily thy water brush is thine own enemy.*

¶ IX.—*Stab not thy pattern with the wire which is called the vent, less thy master look at thee with eyes of scorn.*

¶ X.—*If thou shouldst forget a core, say not, "Forsooth, the rats have eaten it, behold their footprints"; thy fellows will say, "Behold he drinketh too deep of the wine that is red."*

¶ XI.—*Keep thy lifters on the bars of thy boxes, and thy gaggers beneath the bars, lest retribution follow thee, and there shall be wailing and gnashing of teeth.*

¶ XII.—*Verily I say unto thee, "'Tis a wise moulder who knows his own wasters."*

¶ XIII.—*Keep thy vents clean lest thy mould bloweth like unto the whale which did swallow Jonah.*

¶ XIV.—*Bury not thy wasters in the foundry floor, for be assured that thy sins will find thee out when the annual levelling taketh place.*

¶ XV.—*Shouldst thou have the afternoon off to be ill with the head that does ache, choose not a day when the horses do run in the arena lest thy fellows think ill of thee.*

¶ XVI.—*Run not thy mould too cold lest the casting do hold more laps to the mile than any course where the chariots do race.*

¶ XVII.—*When thou feedeth a casting, press not thy rod too far, lest thy casting grow roots like unto the Cedars of Lebanon.*

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¶ XVIII.—*If thy mould doth scab say not to thy overseer, "Behold the cats scratcheth it during the night," forsooth the cat hath nine lives and thou hast only one.*

¶ XIX.—*Ram not thy mould too soft, lest the castings wax fat like unto a man who sells thee the tools of thy trade, and who has bought five yoke of Rolls Royces and has gone to prove them.*

¶ XX.—*Keep well in with thy core-maker lest he deliver thee a core with no vent, saying, "Forsooth, it fell out while conveying it hither."*

¶ XXI.—*Beware of the man who selleth thee dust of the coal and gum of the core, for many are called but few are chosen.*

¶ XXII.—*Beware of the pig-iron salesman who hath no analysis, for neither hath he any brain, and would smite thee in the hinder parts.*

¶ XXIII.—*Alter not thy pattern before the casting is made and delivered, for the Devil roameth about, seeking whom he can devour, and he favours such as these who are like unto his taste.*

¶ XXIV.—*Beware of the examiner who findeth the stopping, which is hard, in thy casting, for verily he hath the eyes of an eagle and can see into the innermost parts of thy handiwork.*

¶ XXV.—*Take heed, and hearken unto the words of Hiram the Moulder, for many would give thee counsel, yet wisdom cometh only from a few.*

TO RAM OR NOT TO RAM?

By J. C. Hallamore.

To ram or to brick your cupola? This seems to be the question of the times, and many of us begin to wonder which is the better method. Manufacturers naturally boost their own materials similarly to each foundryman considering his castings better than his neighbour's. Ramming cupolas has become more popular in recent years, but before changing over from the older method of bricking, it needs considerable thought to determine which method will be the better.

The first factor will be the initial cost of the two methods, and some of the following points must be considered:—(1) Which resists wear and tear to the better advantage? (2) Which gives the better protection to the cupola shell? (3) Which is the better non-conductor of heat? (4) Which lining offers the better resistance to the shock of charging the cupola and dropping the bottom? and (5) when the lining becomes worn and cracked, which will be the more economical to repair?

These are a few points that will run through the mind of the foundryman. If he asks manufacturers for their opinions, such replies as: "Our ganister is the best obtainable for ramming your cupola," or "Our firebricks give better results than any ganister lining," can be expected. The poor foundryman will still be between "the devil and the deep sea." Which way can he turn? Let him go to the Institution of British Foundrymen and hear the opinions of his fellow foundrymen who may use either method—both have many advocates—who can give, and will give advice from practical experience. By comparing his cupola and methods with theirs, and by joining in their discussions, he should come near to the solution of his problem.

It has not been the author's intention to push either method in this paper, as to do so, one needs considerable experience of both, and his has been rather a one-sided one.

The intention has been to bring forward a few debateable points of each method so that by discussion the better method can be picked out.

Gazette.

The public examination in bankruptcy of Mr. J. B. Blackham, carrying on business as a brassfounder at 35, Cox Street West, Birmingham, was held at the Birmingham Bankruptcy Court on January 25. Debtor's statement of affairs showed unsecured liabilities of £3,111 1s. 10d., gross liabilities of £3,202 18s. 2d., and no assets. He attributed his failure to "bad trade, depreciating value of stock, and keen competition." The examination was provisionally closed.

High Chromium Cast Iron Rolls.

By J. Ferdinand Kayser, Assoc. Met.

Although it is generally recognised that small percentages of chromium can, with advantage, be added to material intended for the production of chilled rolls, it does not seem to be so generally known that, for the last twenty years, rolls containing as much as 3.5 carbon and 15 per cent. chromium have been used to a limited extent, and have, in some directions, given exceptionally good results.

Fifteen Per Cent. Material.

The composition usually favoured is as follows:—C, 3.5; Si, 0.7 to 1.0; Mn, 0.3; Cr, 15; Ni, 0.5; S, 0.04; and P, 0.03 per cent.

The above analysis can be obtained in several different ways. One may, for instance, add a low carbon ferro-chromium to a suitable grade of iron. The best results, and the most economical, are, however, obtained by introducing the chromium in the form of ferro-chromium containing from 8 to 10 per cent. of carbon. That is the cheapest form in which chromium can be bought, and, besides having that in its favour, the resulting product appears to be somewhat superior to that obtained when a lower carbon ferro-chromium is used.

Cobalt Molybdenum Additions.

During the last few years for some purposes the above analysis has been considerably modified. The carbon has been reduced to as low as 1.4 per cent. and the chromium to 12 per cent., and 1 per cent. cobalt and 1 per cent. molybdenum have been added. A typical analysis is as follows:—C, 1.4; Si, 0.7; Cr, 12; Ni, 0.5; Co, 1.0; and Mo, 1.0 per cent.

There is no direct evidence that this latter analysis produces a better product than the former. It is, of course, a much more expensive alloy to make. In the author's opinion, the only improvement lies in the addition of the molybdenum, the effect of which will be dealt with later.

Neither of these high-chromium irons can be satisfactorily melted in a cupola, and it is necessary either to melt them in an electric furnace or small Siemens furnace or in crucibles. To anyone used to steel-melting practice, both melt extremely readily, but to those who have had experience only with plain cast iron, the melting would probably present some difficulties, as it is necessary to have a final tapping temperature of approximately 1,450 deg. C.

Melting Details.

If an electric furnace or small Siemens furnace is being used for melting, a bath containing the requisite carbon should be first obtained and the ferro-chromium then added. Ferro-chromium containing 8 to 10 per cent. carbon is usually supplied in the form of large pigs, but these break and crush readily, and it should preferably be added to the bath in pieces about the size of a walnut. Additions of molybdenum, nickel and cobalt can be made either before or after the addition of the chromium. They will, in any event, show no tendency to pass into the slag. After the chromium has once been added, the carbon can only be adjusted either by the addition of anthracite if it is too low or by the addition of wrought iron if it is too high. The amount of carbon in these metals may, however, vary within very wide limits without affecting the properties of the final product, and there is no appreciable difference between metals containing 2½ and 3½ per cent. carbon. If the metal is melted in a crucible, the whole of the charge may be steeled together.

Castings made from this type of metal are always white throughout, even if cast into sand moulds, and there is no known treatment which will precipitate the carbon. Rolls cast in this material are always heat-treated previous to being used, and the method of producing them is essentially different from that followed in the production of ordinary chilled-iron rolls.

Hot Moulds Used.

The metal is cast at as low a temperature as possible into cast-iron moulds of a suitable diameter. The wall thickness should be equivalent to not less than 30 per cent. of the diameter of the roll. In order to obtain a casting with as good a surface as possible, it is advisable to heat the moulds and then to paint them with tar, the temperature of the mould being such that the tar will immediately dry-on without, however, burning. The writer prefers to cast directly into the mould from a ladle fitted with the usual type of stopper. A ½-in. dia. nozzle will be found sufficient for rolls up to 15 cwts. in weight, whilst for larger sizes the diameter may be increased to ⅝-in. Whilst the metal is freezing, it is necessary to feed the casting exactly as if an ingot for forging were being made and, in order to obtain soundness, it is necessary to use a hot fireclay head and have plenty of hot metal to feed in. Generally speaking, a roll casting will require a supply of molten metal for feeding amounting to approximately 7½ per cent. of the total weight of the casting.

Slow Cooling Recommended.

The casting may be allowed to cool down in the mould and, when cold, will be found to have a Brinell hardness of approximately 400 to 450, and will be unmachinable. In order to render it machinable, it is necessary to re-heat it slowly to 800 deg. C., and after soaking for several hours to allow the temperature to fall to about 450 deg. C. at a rate of not more than 30 deg. C. per hour. The casting may then be removed from the furnace and allowed to cool in air. That treatment will reduce the Brinell hardness to 250 to 280.

It is, however, better practice to strip the mould from the casting as soon after pouring as is possible, and as soon as the roll is sufficiently strong to be picked up in the crane to deposit it in dry kieselguhr. The kieselguhr, which should be in powder form, is best contained in a water-tight pit, and the dimensions should be such that the casting rests on a few bricks on edge and is completely surrounded by approximately 10 to 12 in. thickness of the powder. If more than one casting is placed in the same pit, the castings can, with advantage, rest one on another, but they must not be allowed to come in contact with the pit bottom or sides and must, of course, be completely covered with kieselguhr powder.

The castings must be covered before the average temperature has fallen below about 850 deg. C., but it does not matter if the ends and the skin are at a somewhat lower temperature, as when once covered with kieselguhr, the whole temperature will soon become uniform. Kieselguhr powder is such a good heat insulator that a roll weighing not more than 6 or 7 cwt., when packed in it, will be red hot 24 hours after casting, and will not be sufficiently cool to handle until at least five days have elapsed. The slow cooling so produced is the best possible way for softening the castings before machining, and the Brinell hardness falls to between 220 and 250.

It has been the usual practice to machine rolls of this type from solid round castings, but there is no reason why the necks should not be formed in the chilled mould. It is, however, generally found to be more economical to machine from the solid.

Final Heat Treatment.

After machining, the rolls must be hardened. The hardening treatment consists of quenching in oil from 980 to 1,000 deg. C. The hardness will then be 600 Brinell or approximately 850 if measured by the Firth diamond hardness tester.

When molybdenum is present, rolls 10 in. in dia. will be hard to the centre, whilst if molybdenum is absent the hardness will usually penetrate about 4 in. It must, however, be clearly understood that, whether hard or soft, the fracture is always white, and there is no precipitation of carbon.

It might be expected that hardened rolls containing 15 per cent. of chromium would be extremely fragile. Such, however, is not the case. High percentages of chromium produce most unexpected effects when added to an iron, and if the sulphur and phosphorus do not exceed, say, 0.04 per cent. each, the resulting material can be forged and rolled down to very thin sections. In fact, hollow-ground long razors containing 3½ per cent. of carbon and 15 per cent. of chromium have been produced and found to be extremely efficient but, of course, correspondingly expensive to produce.

A Self-contained Railway Wagon Works.

The foundations for the present Coalville Works were laid in 1872, when the late William Stableford opened a very modest works for the building and repairing of railway rolling stock. From the outset the venture was singularly successful and progressive, and Mr. Stableford, who retained control of the business until his death, lived to see the few small shops grow into an extensive and important works. Mr. Stableford died in 1881, and his trustees continued to control the business until 1900, when it was converted into a limited liability company under its present style.

From time to time the works have been extended, the old shops have disappeared, and modern buildings been erected in their stead, and the works to-day cover an area exceeding 30 acres, the north and south sides lying on either side of the L.M. & S. Burton-on-Trent and Leicester line, which is actually the oldest portion of the Midland system, the line having been built by George Stephenson from Swannington to Leicester in 1832. It may here be noted that to Stephenson also we are indebted in great part for the early development of the Leicestershire coalfield. Indeed, appropriately enough, the Stableford Works occupy the site of one of Stephenson's collieries, the shaft and remains of the engine house being still in evidence.

It is worth recording that the district is inseparably connected with railway history, for it was in the neighbouring village of Coleorton that towards the latter end of the 16th century Huntingdon Beaumont laid down the first railways for horse-drawn wagons. The general equipment of the shops does not call for any detailed description as to the various machines installed, for the particular duties are such as one would expect to find in a thoroughly well-equipped modern works.

It may, however, be interesting to note the very large percentage of the workmen who have long periods of service with the company to their credit, the natural outcome being that the men have attained a high degree of skill in the particular work for which they are responsible. Further, born of and fostered by lengthy association, they have also a personal interest in that work, a combination which is beneficial alike to themselves, the company, and the purchasers of the manufactures. Despite the fact of the repeated extensions which have had to be made, and that shops have, of necessity, had to be built on either side of the railway, a remarkable continuity has been retained, and in no department is there any overlapping.

In modern railways-wagon construction the drop forging plays a very important part. In the drop-forging shop there are at the moment fifteen stamps ranging from 5 cwts. to 12 cwts. A new stamp battery is, however, in course of erection, which will comprise two stamps of 30 cwts. and one of 12 cwts. This battery is designed in the main for the production of draw-bar hooks. Hydraulic presses are installed for the bending and shaping of the plates, etc.

The various machine shops are equipped with

FIG. 1.—THE FOUNDRY AT THE WORKS OF STABLEFORD & COMPANY, LIMITED.

The forge and smithy are well laid out for rapid and economical production. In the first named there are six hammers, ranging from 15 cwts. to 40 cwts., whilst the smith's shop is served by ten hammers ranging from 5 to 10 cwts.

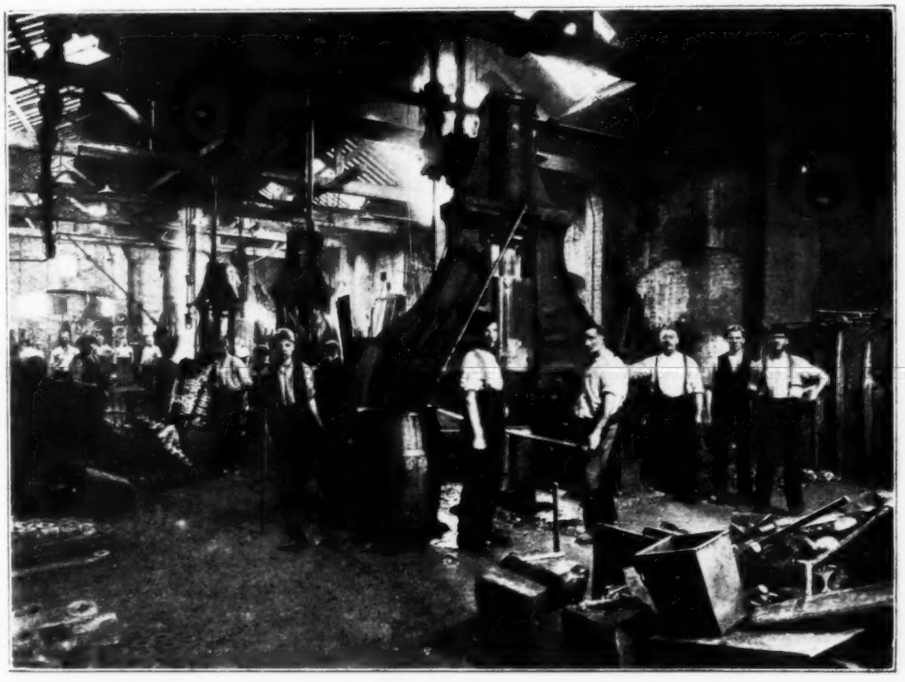

FIG. 2.—THE FORGE AT THE WORKS OF STABLEFORD & COMPANY, LIMITED.

ranges of modern lathes, milling, drilling and planing machines, and there are, of course, also machines which have been specially designed for particular operations, notably amongst which are the gang drilling machines, machines specially designed for boring railway buffers, machines for milling the ends of channel bars, in which six milling cutters operate simultaneously, etc. In the machine shop we were also shown a patent automatic spring shunting lever, which is a speciality of the company. The construction of this lever is such that it cannot assume a position at dead centre, its use thus at once eliminating one of the fruitful sources of derailment.

The tool room occupies a central position in the works, and contains a full complement of modern machine tools, including universal grinders, oscillating tool grinders, profiling machines, etc. In addition to the supply of general tools for use throughout the works, the tool room is responsible for the production of the whole of the steel dies for the drop stamps, and the cast-iron blocks and tools for the steam hammers. A furnace by the Incandescent Heat Company is installed for heat-treatment duties.

The erecting shops, recently considerably extended, now provide accommodation for upwards of 200 wagons, and at the time of our visit the erection of a number of 20-ton wagons was a noticeable feature; some of these wagons are built of iron in order to reduce corrosion, and are more particularly designed for use in the South Wales coalfield. A number of steel hopper wagons were also passing through the shops. Judging also from the various special types of rolling stock for foreign and Colonial duties passing through, it was evident that in the matter of building railway wagons the British manufacturer has retained his hold on the Colonial and foreign market.

One portion of the erecting shop is laid off for the erection and testing of petrol locomotives, which is a manufacture quite recently taken up by the company.

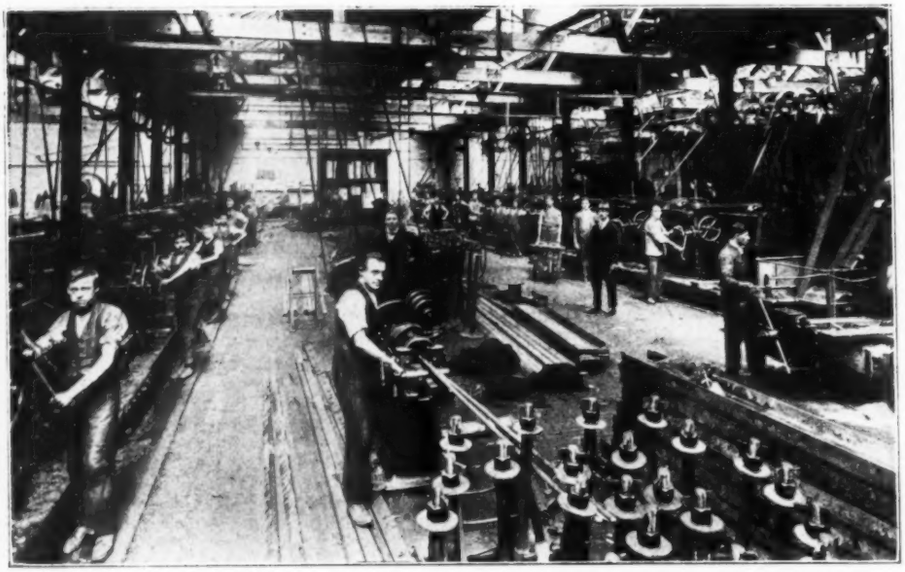

Fig. 3.—The Extensive and Well-Equipped Machine Shop at the Works of Stableford & Company, Limited.

In the foundry, castings up to 4 tons in weight can be made. Naturally, however, for the most part the output is in the nature of light castings, and the work is confined to hand moulding. The two cupolas, each of melting capacities of 3 tons per hour, were built by the company; they are served by an electric hoist, and are tapped into receivers. Blast is supplied by a Keith Blackman fan. In the pattern shop there is the usual range of wood-working machines. There are, of course, painting shops, and also an extensive sawmill, which is exceptionally well equipped.

The large coke car (Fig. 6) built for the Waleswood Coking Company, of Waleswood, Sheffield, is evidence that the activities of the company are not confined solely to railway rolling stock. The car is 40 ft. over headstocks, with an extreme width of 7 ft. 9 in. It runs on six cast steel wheels, and is fitted with spring draw-gear at each end, spring buffers, of the usual railway wagon type, being fitted at one end only. The underframe is built up of 12 in. × 3½ in. × ⅝ in. channels, tied with angle and gusset plates. As the cake of coke is delivered on to the floor of the car in a practically solid piece, the floor has of necessity to be of very substantial construction. It is built of ⅝-in. steel plates, lap jointed and secured to the framework by countersunk rivets.

The car runs on a standard track, and serves the whole battery of ovens, being travelled by cable from a haulage engine.

The car takes the full charge from an oven, which rolls down the sloping floor to the gates. The car is then travelled under the quencher. After quenching it stands for a few minutes to cool off somewhat; it is then travelled to the loading dock and discharged direct into wagons. The gates, it will be noted, are operated by large hand wheels, driving on worm and gear wheels, and are fitted with heavy counterweights to facilitate rapid opening.

A few years ago a scheme was completed for the complete electrification of the works, the contract for which was placed with the General Electric Company, Limited. A site was chosen approximately in the centre of the works, where an entirely independent power house was erected.

The power house contains a 1,250 kva. turbo-generator, consisting of a Frazer & Chalmers high-pressure turbine direct coupled to a G.E.C. 3-phase alternator running at 3,000 r.p.m. 50 cycles 440 volts. The turbine exhausts to a Worthington Simpson surface condenser, in connection with which is a cooling tower by the Premier Cooler and Engineering Company, Limited. There is also installed a Belliss-G.E.C. set of 125 kva., which carries the night and week-end loads. The main switchboard is arranged in a gallery, and the power house is served by a Herbert Morris 12-ton manual crane. The various auxiliary pumps are installed in the basement, and are driven by a 50-h.p. motor. Throughout the works there are several small sub-stations, which contain switchboards for local distribution. So far as practically possible, the 25-h.p. squirrel-cage motor has been made standard, the speed in all cases being 960 r.p.m. Each motor is served by an auto-transformer starter.

Steam is raised in two Daniel Adamson Lancashire boilers, 30 ft. by 8 ft. 6 in. The boilers are fitted with Green economisers and Adamson superheaters, and supplied with the Louis Prat system of induced draught. Steam is raised at 200-lbs. pressure, and superheated to a total temperature of 500 deg. F. The boiler feed pumps are by Clarke, Chapman & Company, Limited.

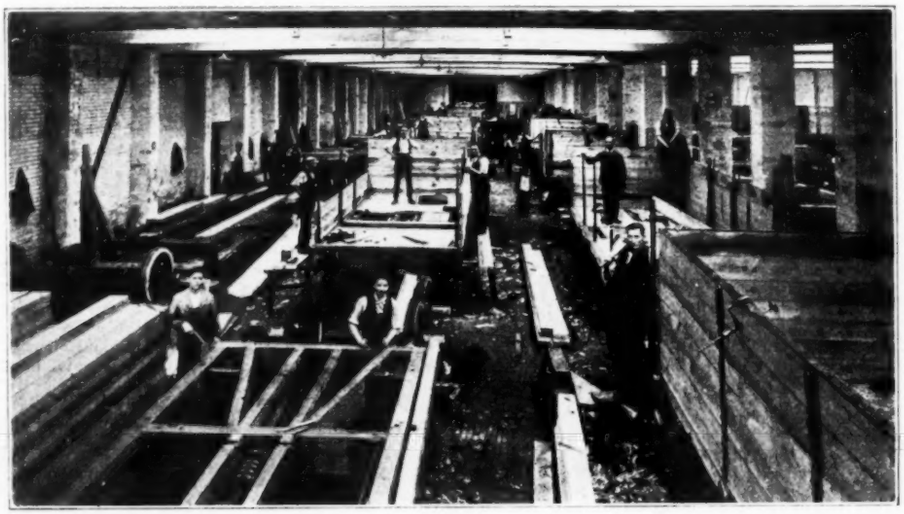

Fig. 4.—The Wood Wagon Shop; Works of Stableford & Company, Limited.

Fig. 5.—The Steel Wagon Shop; Works of Stableford & Company, Limited.

As the result of a meeting held at the Central Hall, Westminster, it is proposed to form an engineering council for the London and district area on lines similar to the one carried on at Manchester. The council will be open to all sections of the engineering industry—employers, trade union leaders, managers, foremen, draughtsmen, clerical staff, and men from the workshops. Its objects will be to provide facilities for personal intercourse between employers and workers, to furnish opportunities for general discussion, to carry out investigation and study of the conditions and problems affecting the working of the engineering industry, and to formulate constructive proposals.

A Talk on Cast Iron.

At the January meeting of the Junior Section of the Lancashire Branch of the Institute of British Foundrymen, Mr. F. J. Cook, M.I.Mech.E., of Birmingham, lectured on cast iron. He was introduced by the chairman of the Section, Mr. T. Makemson, who said Mr. Cook was keenly interested in the work of the Junior Sections, and one had been established in connection with the Birmingham Branch. His research work in cast iron and various phases of cupola practice had made him well known in the metallurgical world.

FIG. 6.—COKE CAR MADE BY STABLEFORD & COMPANY, LIMITED.

MR. COOK said the Institute had done more truly educational work in the foundry industry than had been done by any Association in any other industry. Iron in various forms was indispensable to modern civilisation, and it offered a vast field for study and investigation. What had been done so far only amounted to scratching the top.

Illustrating his remarks with lantern slides, the lecturer described the constituents and physical properties of cast iron, the methods of analysis and testing, metallography, and the assistance given by the microscope and the photographic lens. He observed that in the normal process the oxides contained in the ironstone were melted by gases and pellets of more or less pure iron were produced. These, in passing through the furnace took up carbon, silicon, phosphorus, manganese, sulphur, and formed compounds which could be readily melted within the range of temperatures obtained in the blast furnace. Twenty-five or more cwt. of coke was required for the production of one ton of cast iron. Then to convert it into wrought iron in the puddling furnace another ton or more of fuel was consumed.

It was possible to improve on that method and produce iron more or less pure with a consumption of four cwt. of coke to the ton of metal.

A vote of thanks to the lecturer was passed on the motion of Mr. Yeoman, seconded by Mr. J. Yates.

MR. J. S. G. PRIMROSE emphasised some of the points Mr. Cook had made. Graphite carbon was the one element in cast iron; other constituents were compounds. The size and number of the crystal grains were not so important as the manner in which they were gathered together, segregated, or dispersed. Judging by fracture was not relied upon to the same extent now as it used to be. It was necessary to know what the microscope revealed.

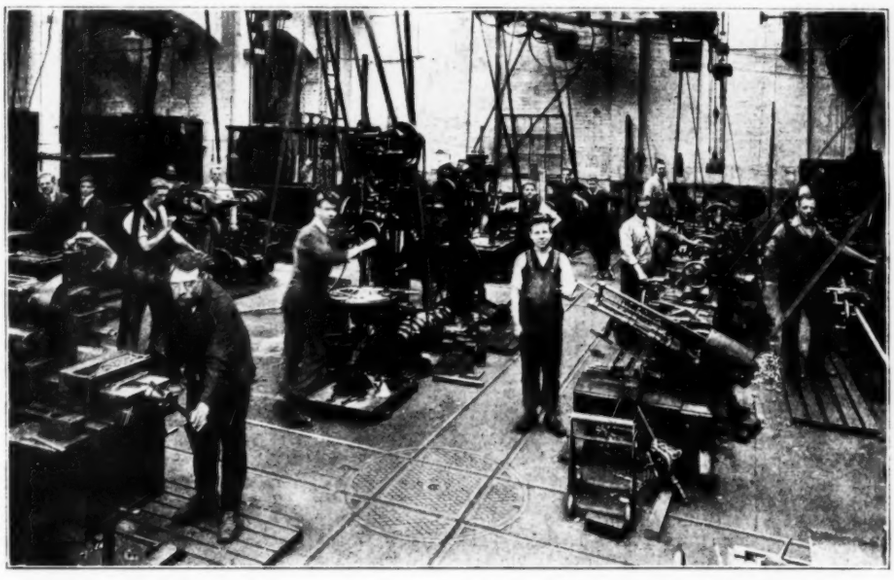

FIG. 7.—THE TOOL ROOM AT THE WORKS OF STABLEFORD & COMPANY, LIMITED.

MR. COOK said to a certain extent he was a believer in judging by fracture. He certainly would not ignore it; but neither would he ignore metallography and chemical analysis. From his lecture the members would have gathered that metallography was something more than a glorified method of judging by fracture.

MR. H. SHERBURN observed that the statement that so far only the fringe of the subject had been touched was very modest, considering the amount of work Mr. Cook himself had done in regard to it. When the atom was known more fully it might throw an entirely new light on the constitution and application of materials.

THE SECTION-PRESIDENT remarked that a great change had taken place in that many people now attached great value to chemical analysis. There was something to be said for practical experience as well, but the technical side could not be ignored.

Institute of Metals.

As already announced, the 20th annual general meeting of this Institute will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1, on Wednesday and Thursday, March 7 and 8, 1928, at 10 a.m.

On March 7 the annual dinner of the Institute will be held at the Trocadero Restaurant, Piccadilly Circus, W.1, at 6.45 for 7 p.m.

The following Papers are expected to be submitted:—(1) The Effect of Quenching and Tempering on the Mechanical Properties of Standard Silver," by A. L. NORBURY. (2) "The Constitution of the Alloys of Magnesium and Zinc," by R. CHADWICK. (3) "Historical Note on Density Changes caused by Cold-working of Metals," by HUGH O'NEILL. (4) "Minute Shrinkage Cavities in Some Cast Alloys of Heterogeneous Structure," by WILLIAM A. COWAN. (5) "Note on the Composition of Old Roman Lead," by WILLIAM A. COWAN. (6) "An Example of Roman Copper 'Soldering' and Welding from Uriconium," by J. NEWTON FRIEND and W. E. THORNEYCROFT. (7) "Season-Cracking of Small Arms Cartridge Cases during Manufacture," by MAJOR F. S. GRIMSTON. (8) "The Influence of Dissolved Gases on the Soundness of 70:30 Brass Ingots," by G. L. BAILEY. (9) "The Relative Corrodibilities of Ferrous and Non-Ferrous Metals and Alloys. Part I.—The Results of Four Years' Exposure in the Bristol Channel," by J. NEWTON FRIEND. (10) "The Thermal and Electrical Conductivity of Some Aluminium Alloys and Bronzes," by EZER GRIFFITHS and F. H. SCHOFIELD. (11) "The Alloys of Zirconium.—I," by T. E. ALLIBONE and C. SYKES. (12) "The Deterioration of Lead Cable Sheathing by Cracking, and its Prevention," by S. BECKINSALE and H. WATERHOUSE. (13) "The Dilatometric Study of Light Metals," by MAX HAAS. (14) "The Ball Hardness and the Cold-Working of Soft Metals and Eutectics," by F. HARGREAVES. (15) "The Behaviour of Metals and Alloys during Hot-Forging," by W. L. KENT. (16) "On the Quenching and Tempering of Brass, Bronze and Aluminium-Bronze," by TSOTOMU MATSUDA.

Bradford Foundry Library.

The West Riding of Yorkshire Branch of the Institute of British Foundrymen, whose meetings are mostly held at the Bradford Municipal Technical College, has now definitely established its new technical reference library. The rules provide that the books are available for any member or associate whose subscription is not more than 12 months in arrear. Not more than one book may be borrowed at a time except in cases of special study, for which special facilities may be given by the librarian. Books must be changed or renewed at the close of the monthly meetings of the Branch in winter, and at stated periods in summer. There will be a fine of sixpence for any book kept beyond the prescribed time unless renewed in the ordinary manner, and borrowers will, of course, pay for any damage or loss. The library is housed at Bradford Technical College.

United States Steel Corporation.—The earnings of the United States Steel Corporation for the fourth quarter of 1927 were the poorest recorded since 1922. They are reported at $31,000,000, or $1.05 per share, against $41,000,000, or $2.14 per share, for the previous quarter and $53,000,000, or $4.88 per share, for the fourth quarter of 1926. The net result of the fourth quarter is a deficit of $4,967,000, as against a surplus of $31,000,000 for the fourth quarter of 1926. For the full year the surplus for dividends is $87,833,000, compared with $116,667,000 for 1926.

Institute of British Foundrymen.

BIRMINGHAM BRANCH ANNUAL DINNER.

The President of the Institute of British Foundrymen (Mr. J. T. Goodwin, of Chesterfield) was, with Mr. Tom Mackemson, the General Secretary, the chief guest at an informal dinner and smoking concert organised by the Birmingham, Coventry and West Midlands Branch at the Engineers' Club, Birmingham, on Saturday evening, January 28, when Mr. F. C. Starr (Branch President) occupied the chair. Mr. J. B. Johnson (a Past-President of the Branch) proposed the toast of "The Institute," and commended the efforts of the President in striving to develop the Institute, whilst also saying a word of appreciation regarding the work of the Secretary in bringing in new members.

In response, the President of the Institute said, Birmingham had a great deal to be proud of in regard to the Institute of British Foundrymen, for it was in their city that it was founded. But Birmingham also had a great responsibility because it was a duty which they owed to the founders of the Institute to carry on the traditions which those founders had created for the benefit of posterity. In this connection, the President referred to the late Mr. Robt. Buchanan, Mr. F. J. Cook, Professor Turner, and many others, including several other past Presidents, all of whom had worked so hard to bring the Institute into the position it had attained to-day. He did not know any branch, continued Mr. Goodwin, which had at its beck and call such facilities as they enjoyed in Birmingham. Indeed, Birmingham had almost everything it could desire to further the interest of the Institute. Although Birmingham had a membership of about 200 in round figures, yet he observed that since 1912 they had been practically stationary. However, they were all pleased to find that the Institute had a satisfactory membership of 1,700, lapses in membership such as they had experienced in the past was a matter which he wanted to guard against. Mr. Johnson, he noticed, had mentioned that 97 new members were reported at the last Council meeting. Mr. Johnson had certainly struck a happy note in saying that their General Secretary had performed much valuable work, but notwithstanding his efforts, their membership was not really progressing very much, as it hovered round about 1,550, 1,650 and 1,700, and never seemed to get much further until last year. The explanation was that the Institute did not keep up the continuity of its membership, hence he wished to emphasise that it was useless to congratulate themselves on obtaining 97 new members if they found themselves at the end of the year with 97 vacancies through losses. Stressing the point that only by enthusiastic effort on the part of the members could the Institute make any substantial advance, there should certainly be an increase in the membership for Birmingham and district, considering the facilities which they had at their doors, and he thought that a good deal of fruitful propaganda work could be done there. He suggested that with the authority or privilege which they had as controllers or directors of labour, they should adopt the plan which he and others had put into practice of fostering and encouraging the interest of members already in the movement; and if they could do this with success, then the rest would follow.

Education.

On the subject of education, especially with regard to apprentices and moulders on the floor, it was a question which required their serious co-operation and consideration. There were no two opinions but that much more could be done. They could stimulate interest in this matter, and also do something for the Institute as regards increasing its membership, by persuading their colleagues in the same works—whether a colleague worked on the factory floor, in the technical office, or was on a departmental staff or manager of the whole concern—to attend their Institute meetings. Their General Secretary was prepared to come to Birmingham and render all the help that was possible. He understood they had arranged a meeting for March 22, and that Mr. Makemson was available to give them a lecture on "The Education of Apprentices." In this connection he suggested that the Birmingham Council should hold a propaganda week, say, of three or four days at least, and he would see that they had the services of Mr. Makemson for the whole of that time. Their Birmingham President, with the help of their able local Secretary (Mr. F. K. Neath) and other officials, could draw up a programme and include in it not only employers, but also employees. He realised that the future of the Institute was wrapped up in the continuity of its membership, Mr. Goodwin went on. Most of them would say that as an Institute they desired to educate the actual moulder in order to enable him to appreciate that research was doing something that would be of benefit to him. And they wanted these young people to realise that if they were to benefit by this research they must attend classes, so that their minds could be trained to absorb technical information which research made available. To this end they had to encourage their apprentices and show them that they were interested in their welfare. Of course, with prices cut to the level they were to-day, the position for both master and man was difficult. It was very difficult for an employer to say that he had the money available to pay for these classes, or to afford his employees time off to attend them. When they had secured the attendance of the apprentices at these technical classes, at the technical school or at the University, continued the President, he might say that their next position was this: Both as employers and as workers they must go to the various education authorities and inform them that the present facilities were inadequate from the teaching side, and that they were prepared to state what was required in this direction, how it should be done, and how necessary it was that improved provision should be made in order to maintain the efficiency of what was a basic industry. A report had recently been issued by an influential committee, representing not only technical schools, but also other associations, from which it was perfectly clear that technical education was going to play a vital part in the future of the country, but its position would not be satisfactory until the industries and the schools came together, and until men in the industry were prepared to say what kind of tuition was required, and assist in providing it. This report was valuable because it confirmed what many in the founding trade had been feeling for years, and now they found it was true of other trades as well.

Apprenticeship Training.

Proposing the toast of the "Birmingham, Coventry and West Midlands Branch," the General Secretary of the Institute (Mr. T. Makemson) said the Birmingham Branch had carried on a most valuable work since the Institute was founded which had undoubtedly been of great service to the foundry industry in the district of which Birmingham was the capital. There had, as the President said, been many prominent members associated with their Branch. For instance, it had supplied three Presidents, including Mr. Buchanan (the first President), and another active member was Professor Turner, whose work in research they all admired. A few years ago a daughter branch at Coventry came into existence, mainly as a result of work done by the Birmingham Branch, but subsequently Coventry had become merged and set up joint housekeeping with Birmingham. (Laughter.) In more recent years they had taken an active part in training apprentices. He believed it was some two or three years ago that Mr. Cook started an informal class with a few foundry apprentices as students, and it was encouraging to find that in a very short time that class developed into a fully-fledged junior section. He had the pleasure of attending the opening meeting and of observing the progress which had been made among the apprentices, and he might say that many prominent members of the Institute were watching this movement with more than ordinary interest. This particular educational work was, they all recognised, going to be of immense value in the future, for thoughtful people connected with their industry were very much concerned with regard to the personnel of the foundry as the years passed by. Some systematic effort had to be made to train their young men, otherwise, in a few years' time a serious position would arise as to the efficient running and staffing of the foundries in the country. As General Secretary he had unique opportunities of seeing the vast amount of voluntary work done by the Institute, and what had struck him more than anything else was the enthusiastic efforts of so many members, all thrown in the scale for the improvement of technical skill and advancement. Much of this extraordinarily good work was performed by the branches through their Presidents and Secretaries and Committees. In this connection Mr. Makemson said he did not think some of them sufficiently realised what a debt of gratitude they owed to those gentlemen who prepared and delivered papers and lectures before the various branches. (Hear, hear.) He himself was now engaged in preparing the next Volume of Proceedings, and he was impressed with the enormous amount of technical work which was done in the preparation of these papers and lectures, and with the very free way in which the authors placed their knowledge and experience and investigations at the disposal of the members of the Institute. Access to this experience and knowledge presented by so large a number of qualified people proved more than anything else the value of membership of the Institute. The fact that a man was not working by himself, but could enjoy the co-operative pooling of information and experience, made membership extremely valuable, and was moreover essential to a progressive man. And the best way in which the members could show their appreciation of the efforts of lecturers in spreading their knowledge was to attend these lectures in good numbers, and contribute to the discussion if they had anything useful to say. The more members they had the more valuable the Institute could be on account of this pooling of information. The President had referred to the propaganda work which he had undertaken in various parts of the country, but he should explain that the success which had attended those efforts had not been due to him so much as to the spade work put in by the more enthusiastic members of different branches. In South Wales and Scotland, for example, he found that a number of devoted officials had been hard at work, and it only required a final push to get new members in. Concluding, Mr. Makemson said he would be delighted to assist in a propaganda effort at Birmingham, and he believed that the Branch would develop so that its members would be able to take a greater pride in it than before. He coupled with the toast the name of the Birmingham President, who had earned the esteem and respect of the Council for his level-headedness and enthusiasm in the affairs of the Institute. (Applause.)

In response Mr. Starr remarked that the Birmingham Branch covered a wide area and embraced every branch of the foundry trade. They would therefore understand the difficulties with which the Council was faced in providing a suitable programme for these different branches, and a programme which would satisfy everybody. The officers were always glad to see members taking an active part in Branch work, and welcomed suggestions for improving the organisation and running of the Branch, as well as offers to contribute papers. He was blessed with a willing band of helpers as President, and was more than pleased that the junior section was now on a sound footing.

Among those who entertained the company with songs, recitations or stories, were Mr. Hulse, Mr. Clarke, Mr. F. C. Edwards, Mr. C. Meredith, Mr. W. J. Flavell, Mr. J. G. Pearce (Director and Secretary of the British Cast Iron Research Association), and the President of the Institute, to whom Mr. F. J. Cook proposed a very hearty vote of thanks in observing that the Branch evidently possessed a good deal of talent in those directions.

A Session on Foundry Practice.

The absence of the usual lecturer did not detract in the slightest from the instruction and interest of the monthly meeting of the members of the Middlesbrough Branch of British Foundrymen, on the contrary, enough controversial matter affecting foundry affairs was provided by four of the members to extend the meeting over two hours.

The Chairman (Mr. F. P. Wilson) intimated that the classes at the High School fostered by their Council were a great success. It was thought when they were started that they would be doing well if a dozen or so of their young apprentices attended the classes on foundry methods. "To our surprise," said the Chairman, "some 40 or 50 are attending, and the class has been divided into two sections. It is a piece of constructive work for which we in this district may expect some credit."

FOUNDRY COSTS.

MR. D. G. PENNINGTON opened a discussion on "Foundry Costs." He said it was a subject in which sufficient interest was not taken. The success of the foundry trade depended a great deal on costing, and, incidentally, the rates of pay for the men who were concerned in it.

Costing was a big subject, and it was one which was becoming every day of greater importance, so much so that in that week's JOURNAL there was an article on "Group Costing." Now, group costing really meant that several firms put their heads together and said, in effect, "now look here, we will discuss costs, the object being to stop foolish quotations." From quotations which were made public from time to time it could be noticed there was a very great deal of difference between the cost and the quotations.

A proper costing system would prevent foolish quotations, and he thought the first thing to be done in this direction was to sufficiently departmentalise the work.

"That is," said Mr. Pennington, "to divide all your classes of work into groups. You could take a jobbing foundry and divide it into green-sand section, dry-sand section, etc. Thoroughly to departmentalise is the only way in which you can get what each group of castings is costing, and if you do it properly you will get some surprises."

They would find, continued Mr. Pennington, that some castings cost a great deal less, and others a great deal more than they had thought.

As an example he quoted an instance of a simple balance weight and weighing 5 cwts. and in the shop at the same time two wheels weighing 5 cwts. It was obvious that one took up much more space than the other, yet on the ordinary system of costing they got the same overhead charges on each. Naturally the one must bear the heavier on-cost per ton than the balance weight. That was the one point he wished to stress that night and leave open for discussion the subject of on-costs.

There were three methods of applying on-cost. First it could be done by the ton weight, which, he believed, was the most common method: secondly, by a percentage on direct wages; and thirdly, by the hourly rate. The last two were very much the same thing. If their base rates were properly classed they should bear a definite relation to standard time. His own opinion was that the best way was to put them on a determined percentage on direct wages. The application of on-costs was one of the most troublesome points in costing. By the ton was, to his mind, not worth the time one spent on it. Obviously their costs were going to come out nearly all on an average cost; which was absurd. In good times with a foundry making one class of work the system might be fairly practicable, but in times of severe competition it was, he thought, obvious that such a system would not be economical.

MR. R. RITCHIE said he quite agreed that "per ton" was no method of costing at all and two men could make a ton of castings of one kind a day; but with another type of casting they might only be able to make 7 cwts. a day. Then the on-costs should be roughly three times as much as in the first case.

MR. T. E. BASHFORD thought the time-rate was undoubtedly the perfect system.

MR. S. V. TOY put forward the problem of the jobbing foundry, pointing out that it would be difficult to apply Mr. Pennington's system when probably a particular pattern would never be seen in the foundry again. Again several castings might have to be made of an intricate job.

MR. PENNINGTON said Mr. Toy was confusing estimates and costing. Costs were only obtained for estimating. If the pattern came in different from what was expected then it was just sheer bad luck and they could not help it.

STEEL CASTINGS.

Some problems of steel casting were dealt with in an interesting Paper given by MR. S. V. TOY. The iron foundries of this country, he said, almost entirely adopted the cupola as a means of producing the molten iron for castings, whereas the steel caster had recourse to several types of furnaces for producing his steel. Briefly the following were the most popular:—The open hearth; the electric; the converter (Tropenas and Stock); and the crucible.

It was really impossible to say which was the most successful, but he would take them in turn and give reasons why some were in favour at one foundry and others at another.

The Open Hearth.

By this he referred to the acid process. The steel obtained was considered ideal for steel castings. Unfortunately, unless a fairly large unit was installed, say a 10-ton furnace, the cost of steel was scarcely economical when compared with other methods, as it took from six to eight hours to prepare the steel for the ladle, and it meant laying down sufficient moulds to absorb the whole charge; and so, if the castings to be produced were medium or light in weight, the floor space requisite was considerable. Apart from this, however, it was never successful to run small castings out of a large ladle, and the use of small shanks did not seem to remedy this difficulty when it came to the pouring operations.

Electric Furnaces.

Taking the electric process next, the furnace which had survived all the experimental ones of a few years ago was the arc type, in which two or three graphite or carbon edectrodes are suspended through the roof for conveying the current to maintain the arc which, of course, produced the necessary melting heat. The production of this arc was now almost entirely carried out by using the resistance of the scrap charged into the furnace, *i.e.*, when the electrodes were lowered on to the scrap the resistance to the flow of current from one electrode to the other set up such a heat that the scrap melted away from the electrodes which consequently had to be lowered to keep pace with the melt until a pool of liquid steel formed in the bottom of the hearth.

The other type of arc furnace might be termed the plain arc. In this the arc was struck between the electrodes out of contact with the scrap and was balanced as in the arc lamp by moving the electrodes either together or apart. Of these two types the arc-resistance furnace had survived and in this type an average time for a melt of two to three tons of steel was roughly three hours. Thus, as against the open-hearth furnace of large capacity it had the advantage of flexibility in that for small or medium castings it was not necessary to put down so many moulds at a time and also the boxes were released somewhat quicker. The steel produced was of the best quality, and practically any degree of purity could be obtained. The sulphur and phosphorus were easily reduced to 0.01 per cent. if sufficient time was taken during the melting for oxidising and reducing the steel by means of the slag.

In this country, asserted Mr. Toy, the cost of electric energy had in 90 cases out of a hundred relegated the electric furnace to the background, as far as steel castings are concerned, and so practically the whole of the electric furnaces in England at present in use were operating on special steels, or in some cases, special steel castings only. Besides the cost of the electric process there were other forces operating against its general use. The steel-casting buyer as a rule was not keen to pay any extra price for steel of a good analysis, all he required was a casting which was cheap and reasonably sound, and it was in this connection where the Converter stepped in and supplied the demand.

Converter Process.—The advantages of the Converter in steel foundry practice were many. Amongst these the flexibility stood out very prominent. In the Tropenas Converter the molten iron was run in from a cupola and then blown as in the Bessemer Process, and was more suitable where large outputs of medium weight repetition work obtained. The heat from a 1-ton. converter took only 15 to 20 mins., and these quick heats meant ideal conditions for developing green-sand work in conjunction with moulding machines. Of course, it was recognised, said Mr. Toy, that it was much better to pour a green-sand mould almost as soon as it was made to prevent the castings from being blown.

Stock Converter.

Another type of converter which had met with considerable success was the stock converter, where the pig-iron and scrap were melted in the converter vessel by means of oil, the molten iron then being blown as in the Tropenas. The time taken for a two-ton converter was on the average 45 mins. One got a correspondingly lower output, but when orders were scarce the advantage of the stock in being easily handled, and started up or shut down at will, was demonstrated. The Tropenas, on the other hand, could not be considered economical unless a full day's run was assured.

The crucible process was little used now, as the initial cost of the steel into the ladle rendered it prohibitive so far as steel castings were concerned.

Turning to the comparative values of the steels produced, Mr. Toy remarked that the quality in terms of steel castings did not lie solely in the chemical analysis. In fact, he would place this at the least value if it were not for the carbon content which, of course, regulated the hardness more or less. Broadly speaking the more impurities present up to a maximum of sulphur and phosphorus of 0.07 per cent.; silicon, 0.4 per cent.; manganese, 0.8 per cent., the better the steel from a casting point of view taking everything into account.

In both iron and steel foundries the question of fluidity was one of vital importance. In passing from the liquid to the solid state the steel decreased in volume and this caused a hole to be left in the casting. Various methods had to be adopted to fill up the hole thus formed and naturally to obtain the best casting the cavity should be filled up with molten steel from a feeding head, but he was afraid that if this method was entirely adopted and the welding plant scrapped there would be very few steel foundries in existence at the present time.

To attain a proper feeding effect various methods were adopted, the best of which was the placing of suitable feeding heads on the casting. The position and size of the head was, to his mind, the most important factor, which determined whether a casting was to be sound or otherwise, and unfortunately, the moulders in this country, although they were able to mould their castings true to form, were sadly lacking in knowledge of the behaviour of metal in changing over from the liquid to the solid state. How many castings were ruined through this lack of knowledge? It must be enormous. He considered one of the most essential points in the training of the future moulder must be a study of the word "shrinkage" and how it might best be overcome. The moulder was not altogether to blame, however. The designer of castings in many cases ought also to have a sound knowledge of the difficulties the foundrymen had in overcoming this shrinkage problem, so that, wherever possible he might assist in designing a casting so that it had no large differences in volume at various points.

The view was generally accepted that the more impure the steel the greater the fluidity when molten. In this respect the converter steel seemed

to be more satisfactory than any of the others, and this could be explained as follows:—

At the finish of the blow in the converter the steel is extremely hot and highly oxidised. Deoxidising agents are added and chemical action is set up which generates heat for some considerable time after the metal is run into the ladle. On the other hand, in the electric furnace, the metal is killed in the furnace and hence the heat, due to deoxidisation, has ceased to form before the metal enters the ladle.

This was well borne out in practice, Mr. Toy added, where converter steel was recognised as being capable of retaining its heat twice as long as the electric furnace.

THE CHEMIST'S PLACE IN INDUSTRY.

That the present day demand for a uniform product made it absolutely essential that there should be scientific control in the foundry was the contention of MR. A. G. HARRISON, who said that no foundry could produce day after day castings of definite physical strength where there was no laboratory.

The increased output of a blast furnace produced an iron which was, generally speaking, higher in total carbon than used to be the case thereby giving us a weaker iron—other things being equal. Also, the fracture of an iron was no certain guide to its chemical composition, and in order to produce a uniform product uniformity in chemical composition must be aimed at, and even to-day iron was bought and sold by fracture and with this result: One might find a foundry iron from X's works, varying from 1.9 to 2.6 per cent. Si, a difference of 0.7 per cent. The average might be quite normal, say, 2.25 per cent., but what would happen if there was a run on either the low or high Si. The Si in the castings would range from about 1.8 to 2.5 per cent., and in the case of exceedingly thin castings low Si would probably cause a large percentage to be returned to the cupola. In the case of high Si the castings if thin would be all right, but what would happen to transverse bars? They would be weaker, and would probably fail to stand the necessary tests. This was just a slight illustration to point out the necessity of knowing what went into the cupola. Therein lay the advantage of having a chemist on the spot. He could, if the necessary materials were at hand, save things from going wrong. Or if things had gone wrong, then they could be put right quickly.

Now, assuming a mixture to be necessary, analyses of irons and scrap were required, and who could say better than the chemist what the proportions of metal and scrap should be, as he had all the required information at hand. No matter how carefully mixtures had been worked out to give an iron of definite composition, which under standard conditions of pouring temperature and cooling rates would have a known structural composition, all calculations could be easily upset by: (1) Charges (and here he included coke) not being properly weighed out: (2) varying composition of coke: (3) too much or too little air to ensure proper combustion of the coke.

To find the effect of melting iron with two different cokes experiments were carried out, using a good foundry iron and about 33⅓ per cent. scrap.

The cokes A and B were of similar ash content, but the sulphur was 0.7 per cent. in A and 1.1 per cent. in B. The amount of coke between charges was 200 lbs., and the iron charge 2,000 lbs. The weight of sulphur in the coke charges was therefore 1.4 lbs. in A and 2.2 lbs. in B. It was a well-known fact that iron readily picked up sulphur, and of this available sulphur some went into the slag, some escaped with the gases, whilst the other was retained by the iron. When using coke A there would be 1.4 lbs. sulphur per charge, and with B 2.2 lbs., so there would be the possibility of the iron picking up in A charges 0.07 per cent., and in B 0.110 per cent. sulphur.

The experiments showed that just over half this quantity was taken up by the iron—0.04 per cent. and 0.065 per cent. respectively, raising the sulphur from 0.053 per cent. to 0.093 per cent., and 0.118 per cent. These samples were taken from the cupola spout.

CORE OILS.

The value of core oils to the foundry was the subject of a very practical address by MR. J. HACKWOOD. Old customs, he admitted, died very slowly, but he could assure them that core oils were a boon and a blessing to the foundry. By using core oils many grids, rods and sprigs could be dispensed with, a great deal of labour was saved in grinding loam or sand, and there was no comparison in the getting out of the bores in the fettling shop. Loose irons were better than grids in making oil sand bores, and if placed overlapping allowed for expansion without distorting the bores.

It was not necessary to fill in with ashes or coke. Straw rope and old floor sand was all that was necessary, and much better in the long run. Fairly large cores could be dried in about 30 to 35 minutes in a stove with a temperature of about 350 deg. C.

Mr. Hackwood exhibited many examples of oil cores, and astonished members by mentioning that certain small cores had been made for a rush job at the rate of 30,000 cores every 24 hours.

The Influence of Nickel and Chromium on Cast Iron.*

Recently Published Work.

D. M. Houston[1] emphasises the softening action of nickel on cast iron in stating that it has been demonstated that grey cast iron, containing 0.1 to 0.5 per cent. phosphorus, by the use of nickel, may be made machinable with virtually no silicon present, and containing only nodular graphite. He mentions also good mechanical properties associated with hard yet machinable irons obtained by adding nickel to iron of suitable composition. The uniformity of results obtained in irons with varying silicon, and in varying sections, by the use of nickel additions, is emphasised, and methods of adding nickel to the iron as it leaves the cupola are dealt with. Under the conditions of work performed by the present author,[12] the ratio of nickel to silicon has been demonstrated to be nearer to four to one, rather than as given in Mr. Houston's formula "two of nickel equals one of silicon."

In a further note,[2] Mr. Houston points out that nickel is not a cure for sick iron, but is a means of obtaining better properties from iron already of high quality. He states that high phosphorus iron requires more nickel than does low phosphorus iron to secure the same machinability.

R. S. Poister[3] reviews previous work, showing that it has been confirmed that 0.5 per cent. of chromium, together with 1-2 per cent. of nickel, increases the tensile and transverse strengths, and hardness of cast iron. Nickel and chromium together give better results than does either element alone: the proportion of nickel to chromium should be three to one or two to one, depending on the silicon. This Paper deals primarily with chromium in cast iron.

E. Piwowarsky[4] has experimented with nickel and chromium additions to iron specially treated by first superheating, then chill casting to obtain a white or mottled fracture, and finally by annealing to induce graphitisation. Very fine structures were obtained associated with unusually high mechanical strengths. A further increase in the tensile properties of 10 to 30 per cent. was effected under these conditions by the addition of nickel (less than 3 per cent.) or of nickel and chromium. Samples were readily machinable and good deflections were obtained in the transverse tests, while in the tensile tests strengths up to 47.6 tons per sq. in. were recorded, with elongations of 2 to 4 per cent.

Turner,[5] in the discussion of the above Paper, again drew attention to the need of lowering the silicon in general iron practice if nickel additions were to have a beneficial effect.

Shaw,[6] also in the above discussion, said that certain nickel cast irons appeared more brittle under shock test than those containing no nickel. He gave details of heat-treatment experiments on nickel-chromium cast irons.

Dealing also with special cast irons, Young[7] expressed the opinion that no advantage could be obtained by a combination of alloying and the Perlit process.

Sipp and Roll[8] studied the growth of cast irons when subjected to steam at 450 deg. C., and on heating to temperatures of 600 to 1,000 deg. C., and when used as fire bars. Tests were carried out on bars among others containing 1 per cent. of nickel. It was found that nickel had no marked influence on the growth.

Notes have appeared in the Press from time to time concerning special alloy additions to cast iron. Monel cast iron,[9] a non-magnetic cast iron, showing considerable resistance to corrosion, containing 20 per cent. of nickel and copper in the monel metal ratio, together with 2 per cent. of chromium, and intended as a substitute for bronzes in chemical plant, etc., must be regarded as a special alloy cast iron.

Nichrome B,[10] an iron-nickel chromium alloy, with a nickel crome ratio of 5 to 1, is recommended as a ladle addition to cast iron.

A British Patent[11] relates to the addition of nickel, or of nickel with other alloying materials, such as chromium, to cast irons, etc. A favourable improvement in the properties of the cast iron is claimed. The patent covers the manufacture of nickel alloys of low melting point, as ladle additions to cast iron. Nickel-silicon-carbon alloys, silicon 1 to 10 per cent., and carbon 0.25 to 2.5 per cent., are mentioned, together with such alloys alloyed with amounts up to 50 per cent. of aluminium, chromium, manganese, copper, tungsten, molybdenum, phosphorus, and sulphur, with iron in suitable amounts as a diluting agent if necessary. A form of shot for making the additions is recommended.

The fundamental influence of nickel on iron-carbon-silicon alloys has been studied by the present author with Turner and Hanson, and a Paper on this subject has recently been published,[13] this being the first report on the work in hand at the University of Birmingham on the major problem of the influence of nickel on cast iron.

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[10] * Special Alloy for Cast Iron. "Foundry Trade Journal," 1927, 36, 254.
[11] * Improvements in Addition Material for Ferrous Metals. Brit. Pat. 273,523. July 7, 1927.
[12] * Everest, A. B., Turner, T. H., and Hanson, D.—The Influence of Nickel and Silicon on an Iron-Carbon Alloy. "Iron and Steel Inst.," September, 1927.
[13] Houston, D.M.—Reprint "Am. Soc. Steel Treating," September, 1927.

* From the B.C.I.R.A. Bulletin.

Reports and Dividends.

Mond Nickel Company, Limited.—Interim dividend, 7½ per cent.

The Universal Grinding Wheel Company, Limited.—Dividend, 10 per cent. free of tax.

William Bayliss, Limited.—Interim dividend on ordinary shares, 3 per cent., free of tax.

Shanks & Company, Limited.—Dividend 10 per cent. on ordinary shares; dilapidation reserve, £2,775; general reserve, £15,000; forward, £19,736.

Dalmellington Iron Company, Limited.—Interim dividend, 6d. per share (being at rate of 5 per cent. per annum), free of tax, on ordinary shares.

Boulton & Paul, Limited.—Net profit, £16,670; brought in, £15,806; dividend, 2½ per cent. on ordinary shares; income-tax reserve, £3,000; general reserve, £4,980; carry forward, £17,218.

The Potentialities of the Electric Furnace Examined.

At the conclusion of Mr. H. S. Primrose's lecture to the Lancashire Branch of the Institute of British Foundrymen, an interesting discussion took place. It was opened by the CHAIRMAN (Mr. J. S. G. Primrose), who said the frequency of the electrical current used with the Ajax Northrup furnace was comparable with the frequencies associated with radio and wireless experiments. To induce in the metal inside the crucible the rapid electrical oscillations which generated the heat required to melt it quickly was a remarkable contrast to the ordinary methods with oil or coke, and the description of the process as melting by wireless seemed to have appealed to the popular fancy.

The Question of Relative Costs.

MR. S. G. SMITH said only that week he had read in a weekly periodical a reference to melting steel by radio and it had been very interesting to him to hear the explanation given by Mr. Primrose. Would Mr. Primrose put into terms of £.s.d. the comparison of the respective costs of melting (say, 500 to 600 lbs. of gun-metal) by the Ajax Northrup furnace and by other types in general use with coal, coke or oil. Such information would be a valuable addition to the paper. Mr. Primrose had, indeed, given certain figures of the average cost of melting one ton of extrusion brass (60 copper, 40 zinc) in a 600-lb. Ajax Wyatt furnace. He understood that the £1 3s. 10d. per ton given included overhead charges and everything else, which was a very low figure. The corresponding figures for melting with ordinary pit fires were stated by Mr. Primrose to be £1 16s. In that comparison the Ajax Wyatt came out very favourably, and taking into consideration other advantages it possessed, such as cleanliness, he was brought to the conclusion that the sooner the electric furnace was installed in the brass shops and iron foundries of this country the better it would be for the industry. Could Mr. Primrose hold out hopes that the electric furnace would displace the cupola? He understood that at present the obstacle was the matter of installation and running cost. But it had been in his mind for many years that the electric furnace could be turned to useful account in many large works where turnings and borings accumulated, as it could convert them into commercial metal.

MR. PRIMROSE said he had no figures with regard to the melting of gun-metal in the Northrup furnace; the furnaces of which he had been speaking were installed for high-speed steel melting and his audience might be interested to hear how the costs compared in that case. In Sheffield, with the ordinary coke fire method, the cost of producing a ton of high-speed steel varied from £13 to £18 per ton. With the Ajax Northrup method, taking power at 0.75d. per unit, the power cost £2 13s. per ton, crucibles cost 17s. 6d., and the items for labour, overhead charges and royalty brought the total to £9 per ton. Thus there was a saving of £4 to £9 in the melting of high-speed steel. That was based on a furnace of 450-lb. capacity. The figures he had already given for the Ajax Wyatt, £1 3s. 10d. against £1 16s. with the ordinary coke-fire method, operating in the Birmingham district, also showed a considerable saving.

He did not think there was any prospect of these furnaces replacing the cupola. Cast iron was a comparatively cheap product and the cupola was a cheap method of producing it. High-speed steel, platinum, nickel-silver and other alloys were expensive materials, and the people who were handling them could afford to pay a fair amount for plant. In an iron foundry if the manager said he wanted £4,000 or £5,000 he did not get much encouragement; some people would want a new foundry for that amount.

Hitherto the Ajax Northrup furnace had been much limited in capacity. Those he had described were not more than 450-lb. capacity, but now in America one of 1-ton capacity was being built, so that a big advance had been made. When it was introduced in this country the trouble was to get the electrical generators required; in fact they could not be had from British firms and had to be brought from abroad. In the last year or two, that had been changed, and British manufacturers were making generators which gave the frequencies required, from 500 to 2,000 cycles, and the furnaces which were now being installed were equipped with generators which were entirely British.

Electric Ore Smelting Furnaces.

MR. E. LONGDEN said he believed in America electric furnaces were being used for the reduction of ore into iron. They were constructed something after the fashion of a blast furnace with the electrical arrangements adapted in a suitable form. The ore was in the form of oxide and it was brought into contact with carbon at certain temperatures. It was established that it took a ton of fuel to reduce ore to a ton of iron in the blast furnace; in the electrical furnace something like a quarter of a ton of fuel was consumed in producing the same quantity of product. As an off-set against that there was the great cost of electrical energy. The use of electricity for melting steel had great advantages. A higher temperature could be obtained, the metal was more fluid, a thinner section of casting was possible, whilst the metal would run more freely. It gave greater solidity to the mould metal, but the information given to him by people who had a great deal to do with steel castings was that the improvement in them was not absolutely due to electric melting, but arose partly from superior moulding practice. The mould had to be made to take the metal at the higher temperature, and greater care had to be given to the preparation of the mould, which resulted in better castings.

Electric Steel Demands Superior Moulding Practice.

MR. PRIMROSE said many people who had installed the electric furnace had given testimony to that effect, saying the metal was of better quality and freer from blowholes. It was true also, as Mr. Longden suggested, that the preparation of the mould helped a great deal.

MR. LONGDEN: Does Mr. Primrose think there is actually any great advantage in melting cast iron by electrical energy?

MR. PRIMROSE replied that it depended on the conditions existing in the particular district which was in question. In the United States, electric furnaces were being used for this purpose where pig-iron would have to be brought from a distance. The economic factor was the deciding consideration, and was based on the price at which pig-iron could be delivered and the price at which steel and iron scrap could be bought.

Increase of Capacity to Widen Scope.

MR. R. A. MILES asked whether the lecturer had any records of the use of the Ajax Northrup for melting brass swarf.

MR. PRIMROSE replied in the negative. He added that it ought to be realised that the last furnace he had been describing was only a "baby," which would certainly grow up and have much wider application. It could be applied to the melting of any metal. Just now the capacity was small, but it could be raised to 1 ton or even 3 tons.

Mechanically Charging Electric Furnaces.

MR. LONGDEN asked whether there were any means of mechanically charging large electrical furnaces. He recollected that in a foundry at Philadelphia he saw the charging done by a gang of niggers.

MR. PRIMROSE said with the open-hearth furnace one could take the charge in loading boxes and place it in the furnace by means of a charging machine, but that was in a furnace with ample internal space, and it was not possible to charge like that in the electric furnace. In the electric furnace the charge was small compared with an open-hearth furnace charge, so that it could be charged by hand.

Applicability to Aluminium Swarf.

MR. MILES: Would you recommend it for melting pure aluminium or aluminium swarf?

MR. PRIMROSE said aluminium alloys, though not pure aluminium, had been melted in a demonstration furnace which had a frequency of 1800 cycles. That was rather high as 500 cycles would be sufficient. In Birmingham high-copper alloys and nickel-copper alloys were being melted in a furnace of 500 cycles, and that frequency would be suitable for aluminium and aluminium alloys. The furnace was quite suitable for aluminium swarf.

MR. BRERETON asked whether it was advantageous to stir the aluminium and whether pure copper could be melted in the Ajax-Wyatt furnace—alloying elements being added later?

MR. PRIMROSE said in melting aluminium with the Ajax-Northrup furnace although the aluminium was circulated by convection currents no air reached it, and there was no oxidation of the ingots. With the Ajax-Wyatt furnace, 200 lbs. of broken brass was put in the slot, and after that they could charge in the brass scrap or brass swarf or copper on the top, and make final additions of zinc. But the Ajax-Wyatt furnace would not melt copper, and in any alloy the maximum amount of copper it would melt was 85 per cent. They had not been able to get a refractory which would stand up to a higher copper percentage than this figure. That was where the Ajax-Northrup came in. It would melt copper alloys up to 90 per cent. or higher, and was quite satisfactory.

Effect of High Installation Costs.

MR. MAKEMSON said the figures of operating costs given by Mr. Primrose showed a considerable advantage for the electric furnace, but how far was that counterbalanced by increased interest on capital outlay and depreciation? Certainly the initial expenditure was much greater than with the ordinary method.

MR. PRIMROSE said in the case of furnaces now operating in Birmingham it was reckoned that although the initial cost was considerable it would be cleared off with one year's working due to the savings effected.

MR. HOPWOOD observed that from practical experience in melting nickel silver in the ordinary crucible in the ordinary pitfire they could get 12 to 18 heats with one crucible. That was using half-pots. If it was an 80-lb. pot they would be melting 40 lbs. in it.

Comparative Costs Other than Pit-fired Crucibles.

MR. GEORGE HALL (London Branch) said in considering the adoption of the electric furnace for general foundry practice the determining factor would be the cost, and he would be glad if the lecturer would give comparative figures in respect of the Ajax-Wyatt and also in respect of the Morgan type coke-fired furnace of 400 to 600 lbs. capacity. Would Mr. Primrose recommend that the Ajax-Wyatt should replace the old-fashioned air furnace for melting down 80 per cent. copper and 20 per cent. tin. He remembered melting 5 tons of that metal with a coal consumption of 15 cwts. of coal at 15s. per ton. It was an old-fashioned furnace with just a small blast attachment.

MR. PRIMROSE said comparing an Ajax-Wyatt of 600 lbs. capacity with a coke-fire furnace of similar capacity, the initial cost was greater in the former. But 3,000 tons of brass, and more, could be melted with the same lining, so that although £30 to £40 might be spent, the real cost was less than in the latter case with a crucible costing £3. There was really a big saving in crucibles.

With regard to the melting of gun-metal or high-copper alloys, the Ajax-Wyatt furnace was not suitable for such alloys as no refractory had been obtained to stand up to them. Although the initial cost of the Ajax-Wyatt was high there was the advantage that the metal was produced free from contamination by gas, which was often a big trouble in the brass foundry as it led to a high percentage of scrap. In the Ajax-Northrup furnace the melting zone was as nearly as possible a pure melting operation, and in the years to come furnaces of this type would be employed largely for all metal melting. At present it was too small, and could only be applied to high speed or crucible steel, pure metals or expensive alloys.

Mr. Primrose added that he had melted as much as 7½ tons of gun-metal in air furnaces using coal in about the same proportion as Mr. Hall had mentioned, but occasionally they had considerable trouble with porous castings; they did not always know the cause, but it was probably due to gases picked up during melting.

Foundry Purchasing.—XIX.

By Eric N. Simons.

The Catalogue Library.

Exactly how the catalogue library should be managed depends to some extent on its size and the number who use it. The difficulty confronting every librarian for a buying department is that he has to be able to pick out at once the right catalogue required, keep it in good condition, and see that it is returned to the file without too much delay. The problem is further complicated by the great variations in size, shape, covering, thickness, stiffness, and so forth, among the catalogues themselves. Some will be handsome volumes between stiff cloth covers, measuring anything from 2 in. to 3 in. in thickness. Others will be mere paper-covered brochures. Others, again, will be sectional, *i.e.*, bound in a loose-leaf binder. Some will be square, others wider than long, some longer than wide; a few irregularly shaped. There will be single sheets, sometimes as important as big bound catalogues. With all these the librarian has to deal.

The size of the library governs largely the method of arrangement. If very large, a complicated system such as that employed in large public libraries may be adopted, classification according to subject, with a system of decimal numeration on the lines of the Dewey scheme. Librarians can readily adapt this system to their own needs, and explanation of it here is unnecessary. But the majority of foundry buying-departments will need a simpler plan, obviating the necessity for an extensive card-index to the library, and thereby relieving the statistical clerk of much work. One method is to keep together all the literature issued by individual firms, and file it alphabetically. Thus, any person requiring John Smith's catalogues can find them under S. Where the literature is of the unbound or flimsy type that cannot stand upright of its own accord, it is kept in file boxes, with the names of the firms clearly imprinted on the backs of the boxes. If the sizes do not admit of inclusion in file boxes, being irregular or awkward, folders or binders may be used instead. This method has the advantage of simplicity. Its disadvantage is that there is no ready means of turning up a particular one of a firm's pamphlets. Some of the larger suppliers issue as many as three dozen different publications, none of which overlaps another. The simple alphabetical filing system involves looking through two or three dozen publications of this firm to find the right one. Furthermore, there is no classification into the three classes outlined previously, all being indiscriminately lumped together. Nevertheless, for libraries of moderate size, such as are kept in the same room as the rest of the buying department's fittings and furniture, this system answers well enough for all practical purposes.

Large Libraries.

Libraries of larger dimensions, though not large enough to employ really elaborate systems, might adapt the following method of arrangement to their own requirements. The literature is classified according to size, and it is perhaps found that on the whole six groups will cover all. The various groups are kept on shelves of corresponding height, with a larger number of medium-spaced shelves than of large or small-spaced, since the number of publications of medium size is considerably larger than that of small or large. Each shelf is given a key-letter or number, the former for preference. Thus, the top shelf might be A, the second B. If the number of shelves is greater than is represented by a single vertical stack, the letters must be qualified by governing letters, as shown in Fig. 1. Each piece of literature should have a number, these running from one upwards, beginning with the top row, left-hand stack. Thus, the first book on the top row beginning at the extreme left would be numbered 1. The books themselves, though grouped according to size on different shelves, can be classified as desired in their respective groups. For example, a quarto catalogue of tools published by John Smith & Company will be traced thus: Quarto catalogues are kept on row Hb. The catalogues are classified on the shelves according to the commodities concerned. Tools come under classification S, each classification being placed in its right alphabetical order on the shelf. Smith's tools are filed under classification S in the proper alphabetical order, *i.e.*, under Smith, and the number of the catalogue concerned is 103. In the card-index or shelf-index, whichever is preferred, the reference letters would be Hb.S.103, *i.e.*, shelf Hb, classification S, Book No. 103. Alternatively, the literature could be filed in alphabetical order of firms on the shelves, the size classification being considered sufficient; or, again, it might be grouped on the separate shelves according to its category, *i.e.*, catalogue, price-list, or instruction book. Naturally, it is impossible to lay down a definite rule. Each librarian must adopt the method that seems to him the best, according to his own requirements.

SHELF.

A	Aa	Ab	Ac	Ad	Ae
B	1 2 3 4 5 6	Bb	Bc	Bd	Be
C	Ca	Cb	Cc	Cd	Ce

Fig. 1.—Arrangement of Catalogue Library Shelves.

Literature that is unbound and cannot stand alone on the shelves must necessarily be excluded from a scheme of this sort. Since each piece will be shelved according to size, it will be possible to keep so many in folders or boxes, and the only difference will be that the outsides of these will indicate the exact number of pieces within. Thus, Classification S may consist of three separate boxes, each holding fifty leaflets. The outside of the first box would bear an indication of its contents, *e.g.*, S.101/150, and so on. Each separate leaflet in the box would then carry, on the top right-hand corner, its proper number, and reference would therefore be quite easy.

The card-index necessitated by this system is quite simple. Cards will have to be filed under manufacturers' names and under the materials concerned. It is a good plan to differentiate between the two kinds of cards by printing them in different colours. The object of this is to obviate their being inserted in the wrong drawers. Fig. 2 gives an example of these cards. The librarian, who may be the statistical clerk or a special member of the buying department, will keep this card-index up to date. It is inadvisable

Name.	File No.
Address.	
Subjects.	Remarks.

Fig. 2.—Catalogue Library Card.

to scrap obsolete literature immediately it is replaced by later publications, because reference may have to be made to it in connection with the execution of existing orders.

Some firms prefer the shelf-index to the card-index, though the writer does not share this preference. Fig. 3 gives some idea of the scope of the shelf-index, though its exact character will vary according to the method of shelf-classification adopted.

One matter must not be overlooked, because, if neglected, it has a knack of bringing the finest system of arrangement to ruin. This is the sectional catalogue, favoured by a good many manufacturers and suppliers because of its economy.

SHELF A.

Material.	Letter and No.
Steel.	Section S.
High Speed	a 23/30
Special Alloy	b 51/60
Carbon Tool	a 11/19
Manganese	a 1/10
Stainless	b 30/5
Tools.	**Section T.**
Moulders'	d 1/10
Fettlers'	d 21/36
Smiths'	g 49/76

Fig. 3.—Shelf-index.

The buyer who is irritated by the suggestion that he shall take the trouble to bind up specially a pamphlet sent to him by a manufacturer, and for this purpose save a particular binder sent by the latter, should first see the matter from the manufacturer's point of view, and understand why the loose-leaf or sectional catalogue is adopted. Many firms supply a large number of widely differing commodities. Especially is this true of machinery manufacturers. But the user of one type of machine may have no use whatever for another type made by the same firm. What, therefore, says the manufacturer, is the use of sending to the owner of a small brass foundry a catalogue that describes certain machines that interest only an ironfounder? It merely encumbers his files, wastes his time, and wastes good paper and print. Far better, then, to do away with the comprehensive catalogue covering all the machines made, and supply instead separate pamphlets, each dealing with a certain class of machines, perforated with two holes in the left-hand margin for binding in a handy binder, which can be sent at the same time as the catalogue or pamphlet. Then, the man who wants a jarring machine gets a jarring-machine pamphlet and no other. If, later on, he wants a different sort of machine, the appropriate pamphlet will be sent to him on application, and he will simply bind it up in the binder he already has. A similar procedure is often adopted with price-lists.

The one defect of this method, from the buyer's point of view, is that it places the responsibility for seeing that these separate pamphlets are carefully gathered up and bound in the proper binder on the buyer himself, or on his department. And, unfortunately, too many are apt to shirk this responsibility, leaving pamphlets lying about until they get too dirty to file. Someone then throws them away. Next time it is necessary to refer to the price list or catalogue of these particular goods, the firm's binder is consulted, and the relative pamphlet used for the transcription of details or the comparison of selling-points. But that pamphlet is obsolete, having been replaced by the one which was never filed. In consequence, the buyer's judgments are falsified by inaccurate information, or his orders err, with possibly serious results.

J. Hinckley & Son, 11, East Parade Chambers, Sheffield, have been appointed selling agents for Pease & Partners, Limited, for "Skinningrove" rolled steel joists and sections, and for James Dunlop & Company, Limited, for steel plates and pig-iron. In order to render the best possible service, the company have opened branch offices at 1, Dickinson Street, Manchester, under the supervision of Mr. G. F. Enticknap, late representative of Robert Heath & Lowmoor; also at 39A, New Street, Birmingham, under the supervision of H. Hinckley, who hitherto has been responsible for the sales of alloys and Pease & Partners' pig-irons in the Staffordshire district. The two agencies referred to above were previously held by Messrs. Carrick & Brockbank, Limited, who have now retired from business.

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Foundry
Basic

The
Sheepbridge
Coal & Iron Co. Ltd.
CHESTERFIELD.

Telephone: 2271 Chesterfield.
Telegrams: Sheepbridge, Chesterfield.

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"TEAM" PATENT COKE
SPECIAL FOUNDRY QUALITY

FOR PRICE AND PARTICULARS APPLY TO:—
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NEWCASTLE-ON-TYNE.

TYPICAL ANALYSIS (if necessary guaranteed)

ASH	not exceeding	8%
SULPHUR	,, ,,	0·8%
VOLATILE	,, ,,	1 %
MOISTURE	under	1·50%

GANISTER, CUPOLA BLOCKS, FIRE BRICKS,
FIRE CLAY.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & CO., LTD.
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

Trade Talk.

BOLCKOW, VAUGHAN & COMPANY, LIMITED, Middlesbrough, have blown in a furnace on ferro-manganese.

JAMES P. KERR & SON, 8, Arthur Street, London, E.C.4, coal contractors, have removed to 10, Eastcheap, E.C.3.

IN CONSEQUENCE of the depression in trade most departments of the Mannesmann Tube Works, Swansea, have been closed down this week.

THE FOUNDRY AND ENGINEERING COMPANY, Albion Road, West Bromwich, have removed to new works at Sandwell Road, West Bromwich.

THE S.S. "BARON HAIG," after discharging Indian ore at Workington for the United Steel Companies, Limited, sailed for Rotterdam to load Continental semi-finished products for the Tata Works in India.

CAMMELL, LAIRD & COMPANY, LIMITED, Nottingham, have received from the Central Argentine Railway an order for 1,500 all-steel bogie wagons. Of these 750 will be covered wagons and 750 high-sided open wagons.

MACNAB & COMPANY, sole manufacturers of the Tabor patent moulding machines, sand-preparing machines and foundry plant generally, have removed to larger and more convenient premises at 150, Holborn, London, E.C.1.

THE STANDING COMMITTEE (GENERAL MERCHANDISE), appointed by the Board of Trade, will hold their inquiry whether imported cast-iron enamel baths should bear an indication of origin, at 10.30 a.m. on Tuesday, February 14.

WHAT IS SAID to constitute a record in steel work has been created at the Clydebridge Steel Works, Cambuslang, where a total of 6,532 tons of steel plates rolled by the universal three-high mill has been turned out in an ordinary working week.

THE L.N.E.R. COMPANY have placed contracts for 690 open-spoke and 6,730 disc wagon wheels and axles with several firms, including John Baker & Company, Rotherham (1920), Limited, the Leeds Wheel and Axle Company, Limited, and the Newlay Wheel Company.

THE CLYDE SHIPYARDS have made a good start for the year with an output of ten vessels of 55,925 tons for January. The previous record for the month of January was ten vessels of 58,614 tons, launched in 1922. The current total is, however, very much higher than the average for January, and somewhat above the average for all the months of the year in normal times. It compares with the very small output of one vessel of 5,209 tons in January, 1927.

THE UNIVERSAL GRINDING WHEEL COMPANY, LIMITED, are joining forces with the Morgan Crucible Company. The agreement provides for an increase of the capital of the Universal Grinding Wheel Company to £225,000, of which £75,000 is preference and £150,000 ordinary capital. The Morgan Company will purchase 20,000 of the unissued shares at par and 15,000 shares at 25s., providing a sum of £38,750 as additional capital in view of the expected large increase in business in the near future.

THE CONVICTION that safeguarding was essential to restore the iron and steel industry was expressed by Sir Park Goff, K.C., M.P. for Cleveland, in a speech at Guisborough during the week-end. The industry, he said, had suffered severely from foreign competition, and it was necessary that some steps should be taken to ensure that in the future they would not see ships coming into the Tees and dumping foreign iron and steel. Some form of protection was necessary, and he advised both masters and men to get together to formulate a scheme. "I believe," he added, "that next month a deputation is going from Cleveland, whose livelihood depends so much upon iron and steel, to see the Prime Minister and impress upon him the necessity for the safeguarding of their industry."

AT A SOCIAL FUNCTION, held in the Metallurgical Department of the University of Birmingham recently, an opportunity was afforded of noting the progress that is being made in metallurgical science. Professor D. Hanson, the head of the Department, stated that the principal function of the University was to train men for the metal industries both at home and abroad. The changes in metallurgical science during the past two decades had been very considerable, and had necessitated an alteration in the nature of the education of metallurgists. Formerly a metallurgist was a sort of chemist. Metallurgists were finding posts not only in metallurgical works, but in a wide variety of engineering works, such as automobile, locomotive, shipbuilding and general engineering. At the present time the prospects for men entering upon courses of instruction in metallurgy were most promising since the number of posts available exceeded the supply of men. In the past, practical courses in metallurgy in the University had been largely chemical in character, and the need was now felt for the development of new courses, particularly dealing with the operations of casting and heat treatment of metals.

A NEW TYPE of plant for grinding manganese steel rails and fitted with an extra head for angular work is being supplied by Taskers Engineering Company, Watery Lane, Sheffield, to a local steel firm.

THE ANNUAL MEETING of the Conciliation Board of the South Wales Siemens Steel Association was held at the Swansea Metal Exchange recently. Mr. Frank Rees, J.P. (Llanelly) was re-elected chairman, Mr. J. R. Davies vice-chairman, and Mr. Lewis Jones secretary of the employers' section; and the Right Hon. John Hodge chairman, Mr. W. Mort vice-chairman, and Mr. Morgan Rees secretary of the men's side. In moving the adoption of the annual report, Mr. Rees dealt with the question of foreign competition in the steel bar trade, and held out little hope in the direction of a reduction in the cost of raw materials, transport charges, or of manufacture. They could only hope, he said, to see an improvement through an amelioration of the labour conditions and the rates of pay of Continental workmen, which would result in a higher standard of living, and thus tend to remove the existing disparity between the internal and the external value of the Belgian franc. When that happened, and only when that happened, would they be able to compete with what Mr. Rees considered "illicit and unfair competition." In conclusion, he referred to the movement for industrial peace, and said that if the conferences which were now being held did nothing more than bring about what already existed in the Welsh steel trade, then those efforts would be well worth while. There was no condition so essential for the resuscitation of industry as peace and confidence, which would not be restored to the markets of the world until there was some guarantee of stability regarding costs of production. Mr. John Hodge characterised the Belgian bars as practically bounty-fed steel in consequence of the disparity between the internal and external value of the Belgian currency, and said he would put a countervailing duty on such steel that came into this country.

Obituary.

THE DEATH occurred on January 24, at the age of 65, of Mr. Alfred Schofield Luty, of E. Luty & Sons, fireclay manufacturers, of Elland.

THE DEATH occurred on January 24 of Mr. Robert Gott, York Place, Knaresborough, aged 76, for many years in business as an ironfounder.

MR. JOHN JOHNSTONE whose death occurred at Workington recently, in his 85th year, was the last member of the first team of blast-furnacemen to be employed at the Derwent Works at Workington.

THE DEATH has occurred at Bath of Mr. Arthur William Spence, aged sixty-four, who was proprietor of an engineering works in the South of Ireland. He was president in 1918 of the Engineering and Scientific Association.

MR. W. C. MOUNTAIN, the well-known engineer, died at his residence, 8, Sydenham Terrace, on January 26, following an illness which lasted for about three years. Mr. Mountain served his apprenticeship with his father's firm in Birmingham, and later joined the Gulcher Electric Light and Power Company, where he remained for about five years. In January, 1888, he joined Mr. Ernest Scott, of Newcastle, as partner, the firm being known as Ernest Scott & Company. Shortly after it was made into a limited company under the name of Ernest Scott & Mountain, Limited. Mr. Mountain decided in 1912, however, to resign his position with the company, and commenced practice on his own behalf as a consulting engineer, and later took his son and son-in-law into partnership; the practice being then carried on in the name of W. C. Mountain, Son, & Wood. He acted as electrical expert to the Mining Association of Great Britain in connection with the first set of Electricity Rules in Mines in 1904, and again in 1911, and has been engaged on other matters in connection with the Mining Rules from time to time. He was a member of the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Institution of Mining Engineers, the Iron and Steel Institute, the North-East Coast Institution of Engineers and Shipbuilders, and took active interest in the formation of the Association of Mining Electrical Engineers.

Personal.

MR. F. S. SCOTT-SMITH, general manager of Samuel Fox & Company, Limited, Stocksbridge, near Sheffield, has been appointed general manager of the works owned or controlled in the Sheffield district by the United Steel Companies, Limited.

Will.

MARSH, MRS. FLORENCE, of Hall Road, Handsworth, Birmingham, metal turner £6,590

Contracts Open.

Belfast, February 14.—Iron castings, etc.; iron and steel, etc., for 12 months commencing April 1, for the Corporation. The City Surveyor, City Hall, Belfast.

Birkenhead, February 13.—Iron castings, wrought iron, etc., for 12 months commencing April 1, for the Corporation. Mr. R. W. Johnston, borough engineer and surveyor, Town Hall, Birkenhead.

Birkenhead, February 14.—Wrought-iron and steel bars and charcoal sheets, iron, brass and gunmetal castings, overhead line material, axles and gears, bolts, nuts, woodscrews, files, twist drills and ball races, etc., during year ending March 31, 1929, for the Corporation. The General Manager, Corporation Tramways and Motors, Laird Street, Birkenhead.

Cairo, February 20.—Supply and installation of water piping and fittings, for the Ministry of the Interior. The Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Ref. A.X. 5,858.)

Cardiff, February 11.—100 lamp pillars, for the Town Council. Mr. G. H. Whitaker, city engineer, City Hall, Cardiff.

Leeds, February 17.—(b) Iron and steel, bars, angles, plates, joists, etc.; (c) castings of gunmetal, copper, steel and iron; (d) bolts, nuts, screws, etc.; (e) wrought-iron tubes, fittings, etc.; (f) copper bars, strip, plates, wire, etc., for the Electricity Department during the year ending March 31, 1929. Mr. C. Nelson Hefford, manager, Electricity Department, 1, Whitehall Road, Leeds.

London, E.C.1, February 20.—(3) Cast-iron straight pipes and irregular castings; (21) sluice valves and spindles (M.W.B. pattern), fire hydrants, etc.; and (21a) sluice valves and spindles, etc. (alternative pattern), for periods of six and 12 months commencing April 1, 1928, for the Metropolitan Water Board. The Chief Engineer, Office of the Board, 173, Rosebery Avenue, E.C.1.

London, N.1, February 15.—(7) Iron, steel and tools; (13) castings and other ironwork, etc., for one year from April 1, 1928, for the Islington Borough Council. The Town Clerk, Municipal Buildings, Upper Street, N.1.

London, S.E.1, February 14.—(1) Iron, pig, hematite, West Cumberland (1,000 tons 0.025 s. and p., 500 tons 0.020 s. and p.); (4) one 10-ton steam power bridge erecting crane; and (5) 26 tons steel strip, bright cold rolled, for the India Store Department, Belvedere Road, Lambeth, S.E.1. (Fee 5s. for each schedule, non-returnable.)

London, S.E.1, February 17.—(1) 100 pairs disc wheels and axles, metre gauge; (2) 500 tons electrolytic copper ingot, for the India Store Department, Belvedere Road, Lambeth, S.E.1. (Fee 5s. for each schedule, non-returnable.)

London, S.W.2, February 16.—(1) Sewer castings; (13) iron, steel, etc., for six and twelve months from March 31, 1928, for the Lambeth Borough Council. Mr. O. Cattli borough engineer, Town Hall, Brixton Hill, S.W.2.

London, W.5, February 29.—(10) Iron castings, etc., for 12 months ending March 30, 1929, for the Town Council. Mr. W. R. Hicks, borough surveyor, Town Hall, Ealing, W.5.

Manchester, February 14. — (a) Permanent-way points, tongues and crossings; (Schedule B) copper, brass and steel wire and copper and brass strip, galvanised steel cable; (Schedule H) iron plates, pyramid iron step treads, steel channels, steel tiebars, fishplates, and fishbolts and nuts, bolts, screws, washers, etc.; (Schedule I) tramcar axles, tramcar, wheel tyres and centres, gear and pinion wheels; (Schedule J) iron castings (brake blocks and malleable iron), for the Tramways Committee. Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly, Manchester.

South Shields, February 18.—(7) Cast-iron gullies, manhole frames, etc.; (12) iron and steel horse-shoe nails, files, bolts, nuts, etc., for year ending March 31, 1929, for the South Shields Borough Council. Mr. S. G. Stanton, borough engineer, Town Hall, South Shields.

Warrington, February 13.—Cast-iron gullies, etc., during 12 months ending March 31, 1929, for the Paving, etc., Committee. The Borough Engineer and Surveyor, Town Hall, Warrington.

York, February 13.—Iron and steel, etc., during six months, April 1, 1928, to September 30, 1928, for the Corporation. Mr. F. W. Spurr, city engineer, Guildhall, York.

Leeds, February 22.—Supply and fixing of two weighbridges with a capacity of 20 tons each, for the Leeds Board of Guardians. The Clerk, 11, South Parade, Leeds.

London, S.E.1, February 20.—(1) Pipework, steam, feed, etc., and (2) feed pump, steam-turbine driven, for the Greenwich power station, for the L.C.C. The General Manager of Tramways, Tramways Offices, Victoria Embankment, S.W.1. (Fee £2, returnable.)

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—In accordance with the views expressed in these reports earlier in the year, the outlook in the Cleveland iron trade has developed a steadily improving tendency, with business showing continuous expansion at each succeeding week's markets. A satisfactory symptom of increasing demand is furnished in the steady diminution of stocks in makers' yards, which during the past week or so have been reduced by some thousands of tons, and are now so small as to represent a very limited reserve to meet trade requirements. On the other hand, exports for January have declined slightly, pig-iron shipments from Tees-side being reduced from 18,527 tons to 16,699 tons, of which 5,962 tons were on Scottish account. With the return of a more active demand for home consumption, the question of an advance in Cleveland prices becomes of first importance, and already a rise in quotations has been under discussion amongst the ironmasters, but though present prices scarcely cover the cost of production, it was deemed inexpedient to take any hasty step which might check demand just at the outset of a favourable trade movement. Consequently quotations still remain as the official minima for Cleveland iron:—No. 1 foundry, 67s. 6d.; No. 3 G.M.B., 65s.; No. 4 foundry, 64s.; No. 4 forge, 63s. 6d.

Business in the Tees-side hematite market is also on an improving scale, and it is noteworthy that producers are inclined to take a firmer stand in regard to prices. Earlier in January mixed numbers were sold at as low as 68s., but to-day the quoted rates are 70s. per ton for mixed numbers and 70s. 6d. for No. 1, but buyers can still do business at 6d. less than those figures. On the North-West Coast, Bessemer mixed numbers are still quoted at 70s. per ton at works.

LANCASHIRE.—Demand for foundry pig in this area continues slow, consumers generally complaining of poorly filled order books, and some slight concessions in prices are offered as an inducement to buyers. Only Derbyshire and Staffordshire qualities have thus been affected so far, current values of these for delivery to local works being at 72s. 3d. to 72s. 6d. and 71s. 6d. to 72s. per ton respectively. Scottish brands are on offer at down to 87s. 6d. per ton, with Cleveland iron quoted at round 78s., all for delivery Manchester or equal.

THE MIDLANDS.—Conditions of trade in the Black Country continue unsatisfactory, and the foundry section particularly is experiencing a very lean time. Orders for foundry pig in circulation at Birmingham last week were limited in volume, the following quotations representing current prices for leading brands:—Northamptonshire, 60s. per ton; Derbyshire No. 3, 64s. to 65s.; and North Staffordshire, 64s. to 65s., all f.o.t. furnaces.

SCOTLAND.—The position in the market for Scotch foundry iron continues disappointing, with competition very keen, even for the smallest orders. Makers are doing their utmost to keep quotations stabilised at 70s. for No. 3 f.o.t. furnaces, but some merchants are prepared to accept down to 1s. 6d. per ton less. In doing so they evidently look for still lower prices, but it is difficult to see how any further reduction could be effected.

Finished Iron.

So far as can be observed, there is little improvement perceptible in the demand for finished material, and keen competition is still the rule for any orders coming into the market. Imports of bars from the Continent are still on a heavy scale, and prevent much support being given to home makers, particularly in respect to nut and bolt iron. The quotation for this class of iron is about £9, and the foreign price for No. 3 iron is £5 17s. 6d. delivered Black Country works. Crown iron quotations are unaltered, and this grade is offered at prices varying from £9 5s. to £10 10s. Staffordshire marked bars are in fair request at £12 10s. at makers' works.

Steel.

No fresh developments of outstanding importance can be reported in connection with the steel industry generally, but at Sheffield a fair demand is current for acid billets at the unchanged price of £10 per ton for Siemens, but basic billets are but a poor market, although a slight improvement for hard is reported. The market for wire rods continues to be dull. Soft quality is quoted at £9 per ton, and to meet foreign competition, something lower than this figure is obtainable. The demand for Sheffield's special steels is good and continues to show some expansion. Production of open-hearth steel is inclined to recede, and the output of crucible steel is only on an average scale. In the tinplate market a moderate inquiry only has resulted in a small proportion of orders, the figures reported paid ranging round 17s. 9d. to 17s. 10½d. basis.

Scrap.

Reports from the chief centres of the scrap metal trade are mostly favourable to increased activity of demand, and prices generally have a firmer tendency In the Midlands there is a good inquiry circulating for cast-iron scrap. For machinery quality, in cupola sizes, the local foundries are offering 70s. to 72s. 6d. per ton delivered. Light cast-iron scrap is weak at 53s. per ton delivered. In Scotland also there is a better demand for cast-iron scrap of all classes, machinery being quoted at 69s. to 70s. per ton for material suitable for foundries; clean, heavy ordinary cast-iron scrap to the same specification 5s. per ton less, and for heavy steelworks cast iron 62s. 6d. to 63s. 6d. per ton. Old cast-iron railway chairs are not too plentiful, and some lots have been disposed of at 67s. 6d. to 68s. 6d. per ton. Light cast-iron scrap is quoted at 57s. 6d. per ton. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—The position in the market for warrant copper fully maintains the stability previously reported, and, if anything, values and the slight fluctuations recorded are mostly in an upward direction. Occasionally, however, there has been at times a slight hesitation to enter into new commitments in standard, which wavered to some extent last week, partly under the influence of disturbing reports about the American share markets, but the confidence of the market soon became apparent again under fresh support, which caused values to trend upward, and a firm feeling to prevail.

Official closing price of standard copper have been as follow:—

Cash: Thursday, £62 10s. to £62 11s. 3d.; Friday, £62 7s. 6d. to £62 8s. 9d.; Monday, £62 5s. to £62 6s. 3d.; Tuesday, £62 to £62 1s. 3d.; Wednesday, £61 12s. 6d. to £61 13s. 9d.

Three Months: Thursday, £61 17s. 6d. to £61 18s. 9d.; Friday, £61 17s. 6d. to £61 18s. 9d.; Monday, £61 15s. to £61 16s. 3d.; Tuesday, £61 10s. to £61 12s. 6d.; Wednesday, £61 5s. to £61 6s. 3d.

Tin.—Values of standard tin for cash account have again been depressed, closing some £5 below the level of the previous week, and nearly £50 less than at the corresponding period last year. The explanation advanced by market dealers is that conditions now operating are entirely professional. There is comparatively little support either from America or on Continental account. The expected spring demand for the metal has not as yet appeared, and it is suggested that consumers are carefully watching the market position, and are refraining from providing for requirements until more stable conditions return.

Official closing prices of standard tin have been as under:—

Cash: Thursday, £245 to £245 5s.; Friday, £245 5s. to £245 7s. 6d.; Monday, £242 12s. 6d. to £242 15s.; Tuesday, £238 15s. to £239; Wednesday, £236 to £236 5s.

Three Months: Thursday, £245 7s. 6d. to £245 12s. 6d.; Friday, £246 to £246 2s. 6d.; Monday, £243 12s. 6d. to £243 15s.; Tuesday, £240 5s. to £240 10s.; Wednesday, £238 5s. to £238 10s.

Spelter.—The market for ordinary spelter maintains a fairly firm attitude, despite the opinion generally held that the production is inclined to be higher than warranted by consumption. Values have rallied well on forward purchases, which is surprising considering that the consuming industries are in an indifferent condition. It is probable that much of the strength is being derived from the belief that consumption this year will be materially larger.

The following are the week's prices:—

Ordinary: Thursday, £25 18s. 9d.; Friday, £25 18s. 9d.; Monday, £25 18s. 9d.; Tuesday, £25 17s. 6d.; Wednesday, £25 13s. 9d.

Lead.—Notwithstanding rather freer purchases recently, the situation in soft foreign pig is only slightly improved, anticipations of heavy shipments of the metal from Mexico and substantial stocks privately held in reserve having had an adverse effect on market operations. Yet there is plenty of buying to be looked for from consumers, which should tend to help the market in resisting further weakness.

The week's prices are appended:—

Soft foreign (prompt): Thursday, £20 17s. 6d.; Friday, £21 2s. 6d.; Monday, £21 2s. 6d.; Tuesday, £20 17s. 6d.; Wednesday, £20 13s. 9d.

Patent Specifications.

The following list of Patent Specifications Accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

13,873. GRAFENBERGER WALZWERK GES., and HOLZHAUSEN, F. Method of rolling thin metal plates. May 23, 1927. 281,944.

14,611. KELLY, T. H. Alloys. May 31, 1927. 281,950.

16,968. JOHNSON, J. Y. (I. G. Farbenindustrie Akt.-Ges.). Production of pure iron. June 25, 1927. (Addition to 262,938.) 281,963.

22,270. NELSON, C., and KING, TAUDEVIN & GREGSON, LIMITED. Rotary hearths for furnaces. September 9, 1926. 282,135.

31,279. SIEMENS - SCHUCKERTWERKE GES. Bright-annealing furnaces. (December 12, 1925.) 262,803.

32,001. DETRICK Co., M. H. Covers or closures for furnaces. (December 19, 1925.) 263,182.

32,006. SIEMENS & HALSKE AKT.-GES. Process for producing protective coatings on metals. (December 18, 1925.) 263,183.

14,709. WEICHEL, O. Cupola furnace. (June 2, 1926.) 272,216.

16,269. HUFSCHMIDT, K. Powdered-fuel furnaces. June 18, 1927. 282,297.

27,798. FELDMAN, E. D. Process of coating articles with metal. (November 6, 1925.) 261,017.

27,935. THOMAS, J. H., CLEMENT, W. E., and THOMAS, D. Machines for cleaning and polishing metal plates. November 6, 1926. 282,532.

28,737. DEUTSCHE-LUXEMBURGISCHE BERGWERKS-UND HUTTEN-AKT.-GES., and KOSFELD, W. Machine for shaping and grinding stones for blast furnaces. (November 16, 1925.) 261,416.

7,085. BEESTON, W. G. Regenerative furnaces. (January 14, 1927.) 282,841.

23,153. NEWPORT COMPANY. Process for preventing the dissolution of iron and steel in sulphuric acid. (September 30, 1925.) 259,200.

23,189. GRABLER MANUFACTURING COMPANY. Foundry-moulding apparatus. (September 19, 1925.) 258,621.

BELGIAN MOULDING SANDS

Easily excel all other Sands and Compos for Production of Steel Castings by the GREEN-SAND moulding and coremaking methods, which is our speciality. Put sentiment at one side, let **results** and **costs** determine with whom to do business.

ANGLO-BELGIAN REFRACTORIES,
"Beaumont," Solihull Lane, Hall Green, BIRMINGHAM
Quarries, RUE LONQUE, RANSART, CHARLEROI.

Sterling

MOULDING BOXES

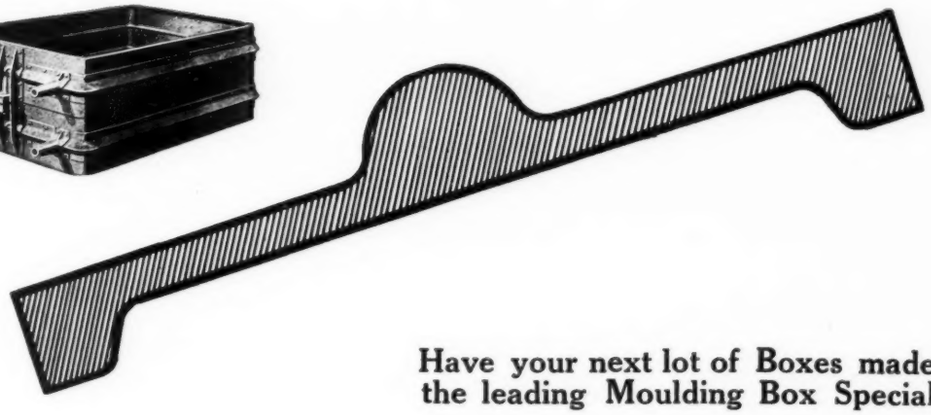
¶ LIGHTNESS AND EASE OF HANDLING;
¶ ROBUST CONSTRUCTION;
¶ DURABILITY AND LONG LIFE;
¶ PERMANENT ACCURACY.

These are the paramount essentials of the modern moulding box.

Sterling Boxes embody all these qualities. They are made from solid ribbed rolled steel of the special section shown below.

Some of the largest and most up-to-date foundries in the country are now completely equipped with Sterling Boxes.

All Sterling Boxes are made to suit the individual requirements of each Foundry. We will drill them to match up to your existing pattern plates or odd-sides and fit them with bars to suit your special patterns.



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STERLING FOUNDRY SPECIALTIES LTD., BEDFORD

London Office:
13, VICTORIA STREET, S.W.1.

Telephone: 3345 BEDFORD.
Telegrams: "STERFLASK, BEDFORD."
Code: WESTERN UNION.

WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	61 12 6
Three months	61 5 0
Electrolytic	66 10 0
Tough	65 0 0
Best selected	65 10 0
Sheets	92 0 0
India	77 0 0
Wire bars	66 15 0
Do. February	66 12 6
Do. March	66 12 6
Ingot bars	66 12 6
H.C. Wire rods	71 0 0
Off. av. cash, Jan.	61 18 11 1/32
Do. 3 mths., Jan.	61 15 0 15/32
Do., Sttlmnt., Jan.	61 18 10 9/16
Do., Electro, Jan.	66 16 1 1/16
Do., B.S., Jan.	66 4 8 3/8
Aver. spot price, copper, Jan.	61 18 11
Do., Wire bars, Jan.	67 1 1 1/4
Solid drawn tubes	13d.
Brazed tubes	13d.
Wire	9 1/4d.

BRASS.

Solid drawn tubes	11 1/2d.
Brazed tubes	13 1/2d.
Rods, drawn	10 1/2d.
Rods, extd. or rlld.	7 1/2d.
Sheets to 10 w.g.	10 1/2d.
Wire	9 1/2d.
Rolled metal	9 1/2d.
Yellow metal rods	7 1/2d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8 1/2d.

TIN.

	£ s. d.
Standard cash	236 0 0
Three months	238 5 0
English	235 10 0
Bars	242 15 0
Straits	240 10 0
Australian	239 5 0
Eastern	245 5 0
Banca	240 0 0
Off. av. cash, Jan.	253 6 5 1/32
Do., 3 mths., Jan.	252 5 1 1/16
Do., Sttlmt., Jan.	253 6 4 1/16
Aver. spot, Jan.	253 6 5

SPELTER.

	£ s. d.
Ordinary	25 13 9
Remelted	25 15 0
Hard	20 10 0
Electro 99.9	30 10 0
English	26 5 0
India	21 15 0
Zinc dust	33 0 0
Zinc ashes	8 15 0
Off. aver., Jan.	26 1 9 3/32
Aver., spot, Jan.	26 2 6

LEAD.

	£ s. d.
Soft foreign ppt.	20 13 9
English	22 5 0
Off. average, Jan.	21 19 10 13/32
Average spot, Jan.	21 15 5 1/2

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	35 0 0
Do. V.M. ex whf.	33 0 0
Rods	41 15 0
Boiler plates	30 10 0
Battery plates	32 0 0

ANTIMONY.

	£ s. d.
Special brands, Eng.	64 10 0
Chinese	45 0 0
Crude	37 0 0

QUICKSILVER.

	£ s. d.
Quicksilver	21 15 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£8 17 6
45/50%	£12 17 6
75%	£20 10 0
Ferro-vanadium—	
35/40%	14/3 lb. va.
Ferro-molybdenum—	
70/75% c. free	5/- lb.
Ferro-titanium—	
23/25% carbonless	11 1/2d.
Ferro-phosphorus, 20/25%	£17 15 0
Ferro-tungsten—	
80/85%, c. fr.	1/3 lb.
Tungsten metal powder—	
98/99%	1/7 1/2 lb.
Ferro-chrome—	
2/4% car.	£32 15 0
4/6% car.	£22 10 0
6/8% car.	£22 7 6
8/10% car.	£22 5 0
Ferro-chrome—	
Max. 2% car.	£35 10 0
Max. 1% car	£41 10 0
Max. 0.70% car	£53 0 0
70%, carbonless	1/2 lb
Nickel—99%, cubes or pellets	£175 0 0
Ferro-cobalt	9/3 lb.
Aluminium 98/99%	£105 10 0
Metallic chromium—	
96/98%	2/11 lb.
Ferro-manganese (net)—	
76/80%, loose	£13 10 0
76/80%, packed	£14 10 0
76/80%, export	£13 5 0
Metallic manganese—	
94/96%, carbonless	1/10 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 6
Finished bars, 18% tungsten	£0 3 0

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under 1/4 in. to 1/4 in.	3d. lb.
Do., under 1/4 in. to 1/8 in.	1/- lb.
Flats, 1/4 in. × 1/4 in. to under 1 in. × 1/8 in.	3d. lb.
Do., under 1/4 in. × 1/4 in.	1/-lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£ s. d.
South Wales—	
Hvy. steel	3 0 0 to 3 2 6
Bundled steel and shrngs.	2 14 6 to 2 18 6
Mixed iron and steel	2 14 0 to 2 15 0
Heavy cast iron	2 18 0 to 3 0 0
Good machinery for foundries	3 0 0 to 3 2 6
Cleveland—	
Heavy steel	2 12 6
Steel turnings	2 8 0
Cast iron borings	2 3 0
Heavy forge	3 12 6
Bushelled scrap	3 2 6
Cast-iron scrap	3 1 6 to 3 6 0
Lancashire—	
Cast-iron scrap	3 5 0
Hvy. wrought	3 2 6
Steel turnings	2 2 6

London—Merchants' buying prices delivered yard.

	£ s. d.
Copper (clean)	50 0 0
Brass (clean)	38 0 0
Lead (less usual draft)	19 0 0
Tea lead	16 0 0
Zinc	17 0 0
New aluminium cuttings	75 0 0
Braziery copper	46 0 0
Gunmetal	46 0 0
Hollow pewter	165 0 0
Shaped black pewter	130 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	67/6
Foundry No. 3	65/-
Foundry No. 4	64/-
Forge No. 4	63/6
Hematite No. 1	70/6
Hematite M/Nos.	70/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	83/-
,, d/d Birm.	87/-
Midlands—	
Staffs. common*	—
,, No. 4 forge	62/6
,, No. 3 fdry.	64/- to 65/-
Shrops. basic	—
,, Cold blast, ord.*	—
,, ,, roll iron*	—
* d/d Birmingham.	
Northants forge	—
,, fdry. No. 3	60/-
Derbyshire forge	60/-
,, fdry. No. 3	64/- to 65/-
,, basic	—
Scotland—	
Foundry No. 1	—
,, No. 3	70/-
Hem. M/Nos.	74/-
Sheffield (d/d district)—	
Derby forge	64/-
,, fdry. No. 3	67/6
Lincs. forge	64/-
,, fdry. No. 3	66/6
E.C. hematite	82/6
W.C. hematite	85/-
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	72/6
Northants foundry No. 3	—
Dalzell, No. 3	100/- to 102/6
Summerlee, No. 3	87/6 to 94/-
Glengarnock, No. 3	87/6 to 94/-
Gartsherrie, No. 3	87/6 to 94/-
Monkland, No. 3	87/6 to 94/-
Coltness, No. 3	87/6 to 94/-
Shotts, No. 3	87/6 to 94/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

	£ s. d.
Iron—	
Bars (cr.) nom.	9 5 0 to 10 10 0
Angles	—
Tees to 3 united ins.	—
Nut and bolt iron	9 0 0
Hoops	12 10 0
Marked bars (Staffs.) f.o.t.	12 10 0
Gas strip	12 0 0
Bolts and nuts, 1/2 in. × 4 in.	15 5 0
Steel—	
Ship plates	8 2 6 to 8 7 6
Boiler plts.	10 10 0
Chequer plts.	10 5 0
Angles	7 12 6
Tees	8 12 6
Joists	7 12 6
Rounds and squares, 3 in. to 5 1/2 in.	7 10 0
Rounds under 3 in. to 3/8 in. (Untested)	7 15 0 and upwards
Flats, over 5 in. wide and up	8 17 6
Flats, 5 in. to 1 1/2 in.	7 17 6
Rails, heavy	8 2 6 to 8 7 6
Fishplates	12 10 0
Hoops (Staffs.)	10 10 0
Black sheets, 24g.	9 17 6
Galv. cor. shts., 24g.	13 0 0
Galv. fencing wire 8g. plain	12 10 0
Billets, soft	£6 0 0 to 6 10 0
Billets, hard	8 2 6
Sheet bars	£5 12 6 to 5 15 0
Tin bars	£5 12 6 to 5 15 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 2 1/2
Sheet to 10 w.g.	1 3
Wire	1 3 1/2
Rods	1 3
Tubes	1 8 1/2
Castings	1 2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3 1/4 to 1/9 1/4
To 15 in. wide	1/3 1/2 to 1/9 1/2
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4 1/2 to 1/10 1/2
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5 1/2
Ingots rolled to spoon size	1/- to 1/8 1/2
Wire round—	
3/0 to 10 G.	1/6 1/2 to 2/1 1/2

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated

	Dols
No. 2X foundry, Phila.	20.26
No. 2 foundry, Valley	17.25
No. 2 foundry, Birm.	16.00
Basic	18.76
Bessemer	19.26
Malleable	19.01
Grey forge	18.51
Ferro-mang. 80% d/d	100.00
Bess rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	33.00
O.-h. billets	33.00
O.-h. sheet bars	34.00
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.80
Skelp, sheared steel	1.80
Steel hoops	2.20
Sheets, black, No. 24	2.80
Sheets, galv., No. 24	3.65
Sheets, blue an'l'd., 9 and 10	2.10
Wire nails	2.55
Plain wire	2.40
Barbed wire, galv.	3.25
Tinplate, 100 lb. box	$5.25

COKE (at ovens).

Welsh foundry	—
,, furnace	—
Durham and North.	
,, foundry	—
,, furnace	13/9
Other Districts, foundry	—
,, ,, furnace (basis)	12/- to 13/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes	20×14 box 17/10 1/2
,,	28×20 ,, 35/9
,,	20×10 ,, —
,,	18 3/4×14 ,, —
C.W.	20×14 ,, 16/10 1/2
,,	28×20 ,, —
,,	20×10 ,, —
,,	18 3/4×14 ,, —
Terneplates	28×20 — per box basis f.o.b.

SWEDISH IRON.

Bars, hammered,	£18 10 0 to 19 0 0
Rolled Ord.	£15 0 0 to £15 10 0
Nail rods	£15 7 6 to £15 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron	£5 15 0 to

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes.	*Fittings.*
Gas	67½%	45%
Water	63½%	40%
Steam	60%	35%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Feb. 2		62	10	0	dec.	5/-
,, 3		62	7	6	,,	2/6
,, 6		62	5	0	,,	2/6
,, 7		62	0	0	,,	5/-
,, 8		61	12	6	,,	7/6

Electrolytic Copper.

		£	s.	d.		
Feb. 2		66	5	0	dec.	5/-
,, 3		66	10	0	inc.	5/-
,, 6		66	10	0	No change	
,, 7		66	10	0	,,	,,
,, 8		66	10	0	,,	,,

Standard Tin (cash).

		£	s.	d.		
Feb. 2		245	0	0	dec.	15/-
,, 3		245	5	0	inc.	5/-
,, 6		242	12	6	dec.	52/6
,, 7		238	15	0	,,	77/6
,, 8		236	0	0	,,	55/-

Tin (English ingots).

		£	s.	d.		
Feb. 2		245	0	0	No change	
,, 3		245	5	0	inc.	5/-
,, 6		242	15	0	dec.	50/-
,, 7		240	15	0	,,	40/-
,, 8		235	10	0	,,	105/-

Zinc Sheets (English).

		£	s.	d.		
Feb. 2		35	0	0	No change	
,, 3		35	0	0	,,	,,
,, 6		35	0	0	,,	,,
,, 7		35	0	0	,,	,,
,, 8		35	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
Feb. 2		25	18	9	dec.	1/3
,, 3		25	18	9	No change	
,, 6		25	18	9	,,	,,
,, 7		25	17	6	dec.	1/3
,, 8		25	13	9	,,	3/9

Lead (English).

		£	s.	d.		
Feb. 2		22	10	0	No change	
,, 3		22	10	0	,,	,,
,, 6		22	10	0	,,	,,
,, 7		22	5	0	dec.	5/-
,, 8		22	5	0	No change	

AVERAGE MONTHLY PRICES OF CLEVELAND No. 3 PIG-IRON.

Year.	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Yearly Average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1887	37 5	35 10	34 4	34 4	34 1	34 10	34 4	34 5	33 9	31 10	31 8	33 6	34 2
1888	32 2	31 1	31 5	31 9	30 11	31 5	32 4	33 5	34 8	34 2	33 11	33 10	32 7
1889	33 8	35 0	37 5	38 9	38 6	37 10	40 1	43 4	44 1	51 5	64 7	61 1	43 10
1890	60 3	53 1	51 0	47 4	42 2	41 5	43 2	45 7	47 9	47 10	47 4	43 1	47 6
1891	42 1	41 10	39 9	38 7	40 9	41 0	40 8	39 8	40 4	39 11	38 8	38 1	40 1
1892	37 7	35 7	36 10	37 10	39 2	40 11	39 11	39 10	40 0	38 6	37 6	37 4	38 5
1893	36 0	34 3	34 4	34 2	33 10	34 8	35 3	35 5	35 4	34 8	34 7	35 9	34 10
1894	35 8	35 11	36 1	36 1	35 5	35 5	35 5	35 11	36 6	35 8	35 8	35 1	35 9
1895	34 7	34 4	34 4	34 8	35 6	35 2	36 1	37 1	38 10	38 6	37 11	37 6	36 3
1896	37 3	38 4	38 7	38 1	37 4	37 4	36 11	36 11	37 11	39 2	40 5	40 5	38 3
1897	41 2	40 4	40 5	39 2	39 7	40 9	39 6	40 5	41 7	42 5	41 5	40 4	40 7
1898	40 9	40 8	40 6	40 0	40 7	39 11	40 4	41 11	43 0	44 11	49 1	44 3	42 0
1899	46 10	47 11	47 9	49 10	55 11	62 10	71 6	65 9	67 7	68 8	70 0	66 9	60 5
1900	67 10	68 10	73 10	76 2	74 2	68 6	69 3	71 4	70 9	67 8	63 6	53 6	68 9
1901	48 0	46 6	45 8	45 5	45 10	44 7	44 6	45 3	45 3	45 3	43 6	43 1	45 3
1902	43 11	46 7	46 9	47 11	48 10	49 7	50 9	52 1	53 6	52 9	50 9	47 11	49 3
1903	47 3	48 9	51 10	49 0	46 1	46 2	46 7	46 8	45 7	43 6	42 10	41 11	46 4
1904	42 3	42 7	43 3	44 7	44 0	42 10	42 9	43 3	43 1	43 9	46 1	48 7	43 11
1905	48 11	48 0	49 6	50 1	51 5	45 6	45 9	47 5	48 8	52 11	52 9	53 3	49 6
1906	53 9	50 1	48 1	48 8	50 2	50 3	50 6	53 0	54 6	56 8	58 6	62 4	53 6
1907	60 4	56 6	54 10	56 0	61 1	58 1	57 8	57 8	55 7	54 8	50 8	50 0	56 2
1908	48 5	49 3	51 7	51 10	51 6	51 2	50 0	51 4	52 0	49 8	49 4	48 11	50 8
1909	48 10	48 1	46 9	47 0	48 4	48 9	48 6	50 5	51 3	51 11	51 2	50 7	49 4
1910	51 10	51 3½	51 7½	50 10	49 10	49 2	48 10	49 8½	49 3½	49 7½	49 6½	49 10	50 4
1911	49 11½	49 2½	48 5	46 11	46 4	46 6	46 11½	47 4	47 0	46 7	47 4½	48 1	47 7
1912	50 0	49 5½	51 1½	53 7½	54 4	55 1	57 5½	64 6½	61 7½	66 8½	67 8	68 0	58 5½
1913	66 11½	63 8½	64 8	67 1½	66 3	56 9½	56 3½	55 8	56 4	53 0	50 1	50 4	58 10
1914	50 11	51 5½	51 0½	51 4½	51 6	51 6½	51 5	52 3	51 5	50 1	50 3	53 0	51 4½
1915	55 7	56 6	61 0	66 7	65 2	66 10	65 4	66 0½	65 3	65 11	69 10½	75 7½	65 7½
1916	80 2	91 6	87 4½	86 10	82 6	82 6	87 6	87 6	87 6	87 6	87 6	87 6	85 10
1917	87 6	87 6	87 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	95 0	91 3
1918	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0
1919	95 0	95 0	95 0	95 0	152 6	160 0	160 0	160 0	160 0	160 0	160 0	160 0	137 8
1920	175 0	175 0	187 6	200 0	208 0	217 6	217 6	221 0	225 0	225 0	225 0	225 0	209 3
1921	222 6	195 0	150 0	126 0	120 0	120 0	120 0	136 3	127 0	120 0	110 0	100 0	137 4
1922	92 6	90 0	90 0	90 0	90 0	90 0	89 0	87 3	92 6	92 6	92 6	91 3½	90 7½
1923	94 6	108 9	125 6	129 4½	128 5	136 0	128 1½	121 11	97 1½	97 0	100 0	100 0	110 6½
1924	99 10	97 3½	91 9	93 9	91 9	89 10½	87 9	85 0	82 5½	80 2½	81 9	81 9	88 7½
1925	80 4½	78 10½	78 0	78 3	76 0	73 10½	71 7½	69 10½	68 1½	66 7½	66 0	66 10½	72 10½
1926	69 4½	70 0	70 0	70 0	72 6	75 10½	86 7½	90 0	93 10½	117 10	120 0	99 0	86 3
1927	85 0	83 1½	81 0	80 0	73 9	70 0	70 0	68 9	67 6	67 6	66 10½	65 0	73 2½
1928	65 0	—	—	—	—	—	—	—	—	—	—	—	—

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